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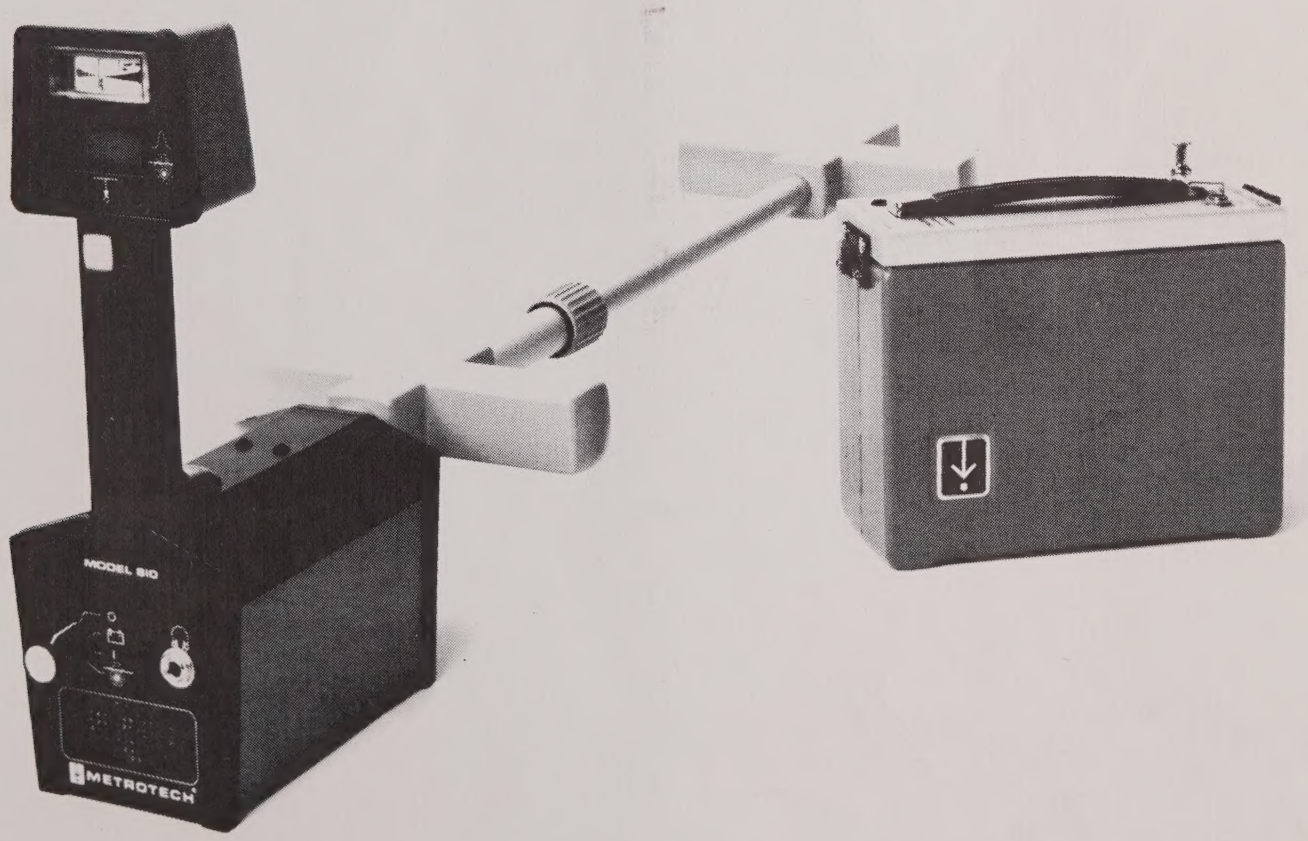
FIELD SERVICE MANUAL FOR THE MODEL 810 LINE TRACER



MANUAL PART NUMBER: 600A045
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SCOPE OF THIS MANUAL

This manual enables a user to maintain a Model 810 in the field. The manual contains three sections as follows:

Section 2. Checkout Procedure

Section 3. Troubleshooting Chart

Section 4. Calibration Procedure

The checkout, troubleshooting and calibration functions must be performed in this order to keep the instrument in proper operating condition.

CAUTION

Only procedures contained in this manual may be performed on the Model 810. If other procedures are required, they may only be performed by a qualified technician.

Sections 5 and 6 contain lists of replaceable parts.

THE METROTECH SERVICE KIT

Three items are required to perform these field service procedures:

1. Field Service Manual (Part Number 600A045). This manual contains all service procedures, troubleshooting information and a list of replacement parts.

2. Test Cover (Part Number 300B038). This cover replaces the operating cover on the Receiver, giving access to the components adjusted during the Calibration procedure.

3. Auxiliary Test Cable (Part Number 300A046). Connects the Receiver to the Transmitter for calibration.

CAUTION

Connect the "R" end of this cable to the Receiver and the "T" end to the Transmitter.

RELATED DOCUMENT

Operating Manual for the Model 810 Line Tracer (Part Number 600A001-A).

USING A "KNOWN BURIED CONDUCTOR"

The Model 810 Line Tracer can also be used to indicate the depth of a buried pipe or cable. A pipe or cable of known depth is required to test and calibrate the depth-measuring capability of the Model 810. This is called the "Known Buried Conductor" in this manual.

Select a length of buried pipe or cable as a test site. This test site should be clear of parked cars and other buried or surface metal objects which may interfere with the transmitted signal. The exact position of the test conductor should be marked on the ground directly over the conductor.

Best results will be obtained if the conductor is 24 to 48 inches deep, has a small diameter, and is straight for at least 60 feet.

Two depth measurements are made in the calibration procedure. The first is made at ground level; the second is made from a position 2 feet above the ground. The best way to make this second measurement is to use a wooden stepladder or wooden platform. The second measurement must always be made from exactly the same height.

FACTORY-AUTHORIZED SERVICE

Troubleshooting procedures beyond those contained in this manual require special test equipment and training. There are crucial adjustments and tuning that must be performed to ensure that product specifications are met. If the procedures given in this manual do not restore the equipment to full operating condition, return the Model 810 to a Factory Authorized Service Center.

A Uniform Magnetic Field Generator (Part Number 800A020) is required to perform troubleshooting procedures beyond the scope of this manual. For more information, contact the Metrotech Customer Service Department using this toll-free number:

1-800-638-7682 (415-940-4926 in California).

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GENERAL

Follow this procedure when the Model 810 fails to operate accurately in the field. If the instrument does not achieve the results given in this test, refer to the Troubleshooting Chart in Section 3.

WARNING

Do NOT operate the Transmitter while it is on or near a metal surface or large metal object. Incorrect test results and battery damage may result.

THE MODEL 810 CHECKOUT PROCEDURE

1. Pull the Transmitter POWER switch ON.

2. Press the TEST switch. The Power Indicator should light to indicate that the battery is good and power output from the Transmitter is adequate. If the lamp does not light, replace the battery and repeat this test.

3. Plug the Metroclamp and cable into the DIRECT jack (see Figure 1) and press the TEST switch. If the Power Indicator does not light brightly, refer to the Metroclamp Adjustment Procedure in this section.

4. Remove the Metroclamp and plug the conductive attachment cable into the DIRECT jack (see Figure 2). Press the TEST switch and check the Power Indicator. If the Power Indicator does not light, check the conductive attachment cable for broken or shorted leads.

5. Turn the Transmitter POWER switch OFF.

6. Fully extend the Receiver Antenna, and lock it into position.

7. Set the Receiver Function switch to the BATTERY position and check that the indicator reads beyond the Battery Test line. Ignore all audio signals. Turn Transmitter Power Switch on.

8. Set the Function Switch to the OPERATE position. This puts the Receiver in the Search mode, and the LEFT/RIGHT indicator swings from side to side. Check that the audio tone is continuous when the Receiver is to the right of the conductor and broken when the Receiver is to the left of the conductor.

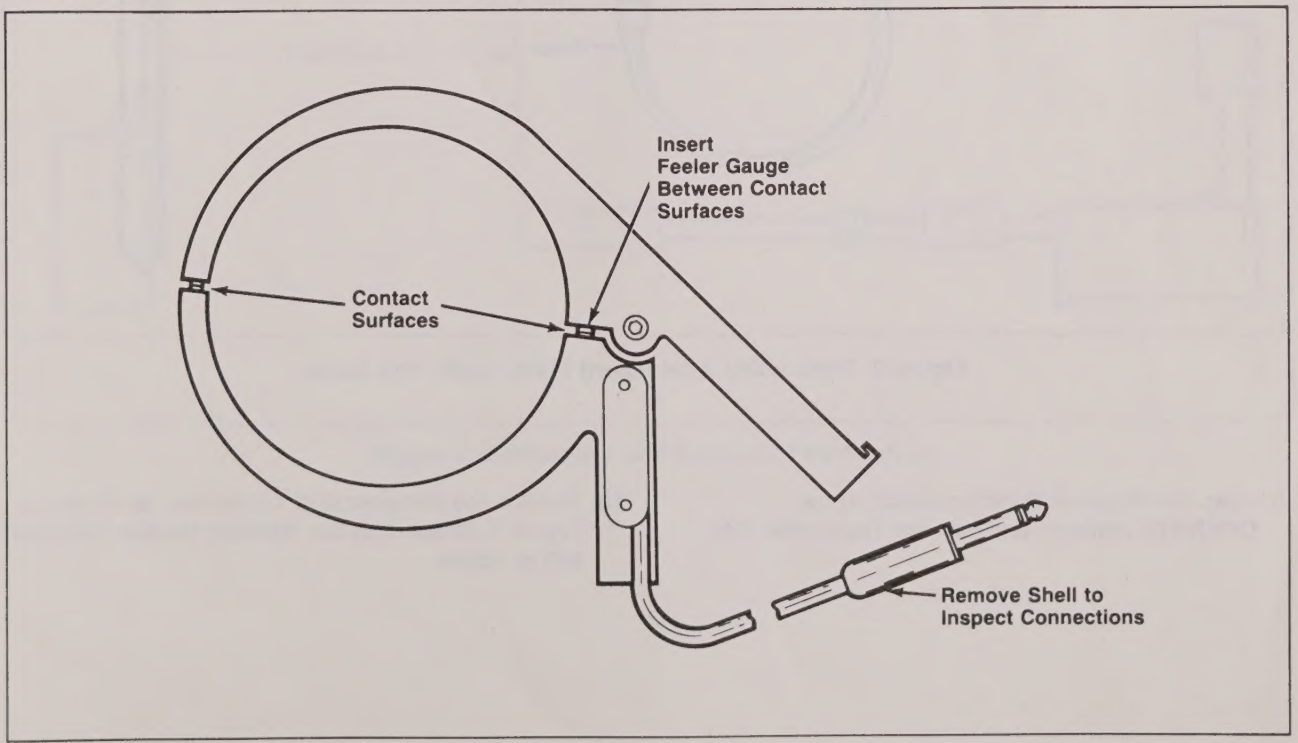

Figure 1 The 4820 Metroclamp.

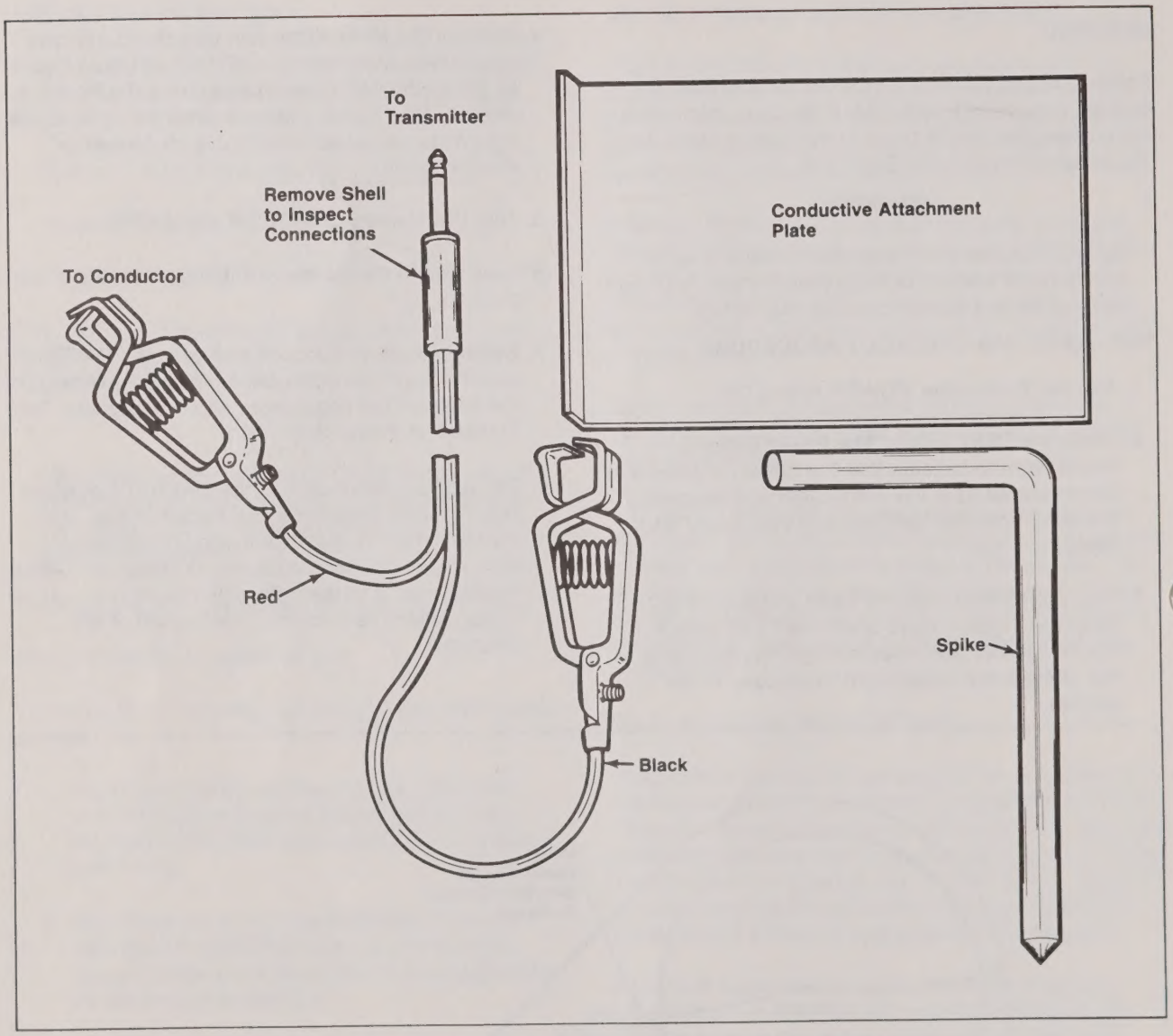

Figure 2 Conductive Attachment Plate, Spike and Cable.

9. Keep the Receiver Function switch in the OPERATE position, and turn the Transmitter ON.

10. Position the Receiver and Transmitter as shown in Figure 3. Check that the Receiver display indicates 950 or above.

11. Move the Receiver 5 feet away from the Transmitter. Check that the Receiver LEFT/RIGHT indicator points to the centerline mark.

12. Point the Receiver to the left and the right of the Transmitter. The LEFT/RIGHT indicator should follow the change of direction, and the audio tone should be continuous (go right) or broken (go left) as the needle changes.

13. Go to the "known buried conductor" and locate the conductor. Check the following:

    a. The depth reading is within 10% of the actual depth,

    b. The antenna is directly over the conductor, and that

    c. There is NO audio tone.

    d. The Left/Right meter needle is on the center line of the meter scale.

4820 METROCLAMP ADJUSTMENT

Tools Required:

1/4-inch nutdriver; Phillips screwdriver; 0.007-inch feeler gauge.

1. Loosen the 1/4-inch nut at the pivot point of the clamp (see Figure 1).

2. Ensure that the four contact surfaces are free of grease or dirt.

3. Place the feeler gauge between the pivot contact points of the clamp (see Figure 1), and fully close the clamp.

4. Tighten the hex nut.

NOTE

It may be necessary to loosen the nut to allow the clamp to spring closed.

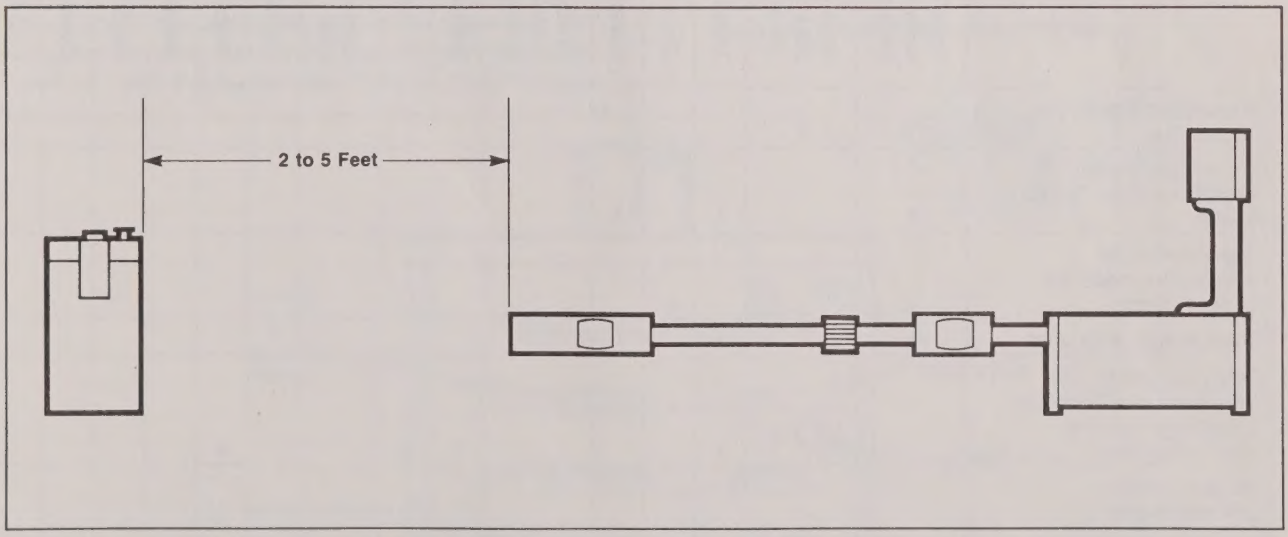

Figure 3 Transmitter and Receiver Test Position.

GENERAL

Table 1 shows a Troubleshooting Chart. If the symptom of a problem has been noticed in a test in Section 1 of this manual, look for this symptom in the left column of the chart. The possible cause is given in the top line of the chart. The body of the chart gives the probability of the cause starting with 1 as the most probable.

HELPFUL HINTS

All Model 810 Receivers and Transmitters are tuned to the same frequency. A Receiver or Transmitter may be operated with another Model 810 instrument to help determine the location of a defect. A module from a working instrument can be placed in a non-working instrument to determine if the equipment can be repaired.

The malfunction may be due to a bad connection. Clean all connectors and board contact fingers with alcohol to improve the electrical connections.

THE TROUBLESHOOTING CHART

	Trans batteries weak or installed incorrectly	4820 Clamp adjusted properly see adj. procedure	Transmitter module	Clamp Plug	Battery Connectors	Check switch contacts on direct jack	Detector meter board	Audio/AGC card	Sequencer/Regulater card	Computer card	Amplifier card	Receiver batteries	Meter	Speaker	LCD Display
Transmitter Power test inoperative	1	2													
Transmitter Battery life short (should be 75-150 hours)	1		2		3										
Trans output OK in inductive mode, nil in direct mode				2		1									
Trans output always nil	1		2												
Trans output OK, but L/R meter needle moves constantly from one side to the other			1				2	3			4				
Weak or erratic L/R movement							3	2			1				
No audio display or meter indication							2	1	3			4			
No Audio								1	3			2		4	
No Display							3			2					1
Depth inaccurate								2		1		3			
Depth readings drifts							2			1	3				4
No L/R movement								2			1		3		
Field strength reading No Depth										1					

GENERAL

This procedure should be performed when one of the tests in Section 1 indicate that the instrument requires calibration, or a part has been replaced. Perform this procedure on the "known buried conductor" using the wooden step ladder or wooden platform for the second depth calibration test.

This test is performed with the Receiver cover replaced by Test Cover 300B038 to allow access to the adjustable components. Use a small slotted screwdriver to make the adjustments.

THE AUXILIARY CALIBRATION PROCEDURE

1. Take off the Receiver cover (Item 6 in Figure 7) by removing two phillips-head screws, and pulling off the battery access cover.

2. Install the Test Cover (300B038) with one screw. Close and latch the battery access door.

3. Connect the Receiver and Transmitter using the Auxiliary Cable (300A046). Insert the cable end "R" into the Receiver AUX INPUT jack. Insert the cable end "T" into the Transmitter DIRECT OUTPUT jack.

4. Set the Receiver control to the AUX mode position. Point the Receiver away from the Transmitter.

5. Turn the Transmitter ON.

6. The Receiver should indicate 450. If not, adjust the AUX LO control (2 in Figure 4) until it does.

7. Remove the Auxiliary Cable from the Receiver and the Transmitter.

8. Set the Receiver and Transmitter 2 feet apart, as shown in Figure 3.

9. Adjust the AUX HI control (3 in Figure 4) for a reading of 975.

NOTES

1. Some early Model 810 instruments do not have an AUX HI control, or the control is located on the back of the Audio AGC module.

2. Leave the Test Cover on the Receiver and perform the Depth Calibration Procedure.

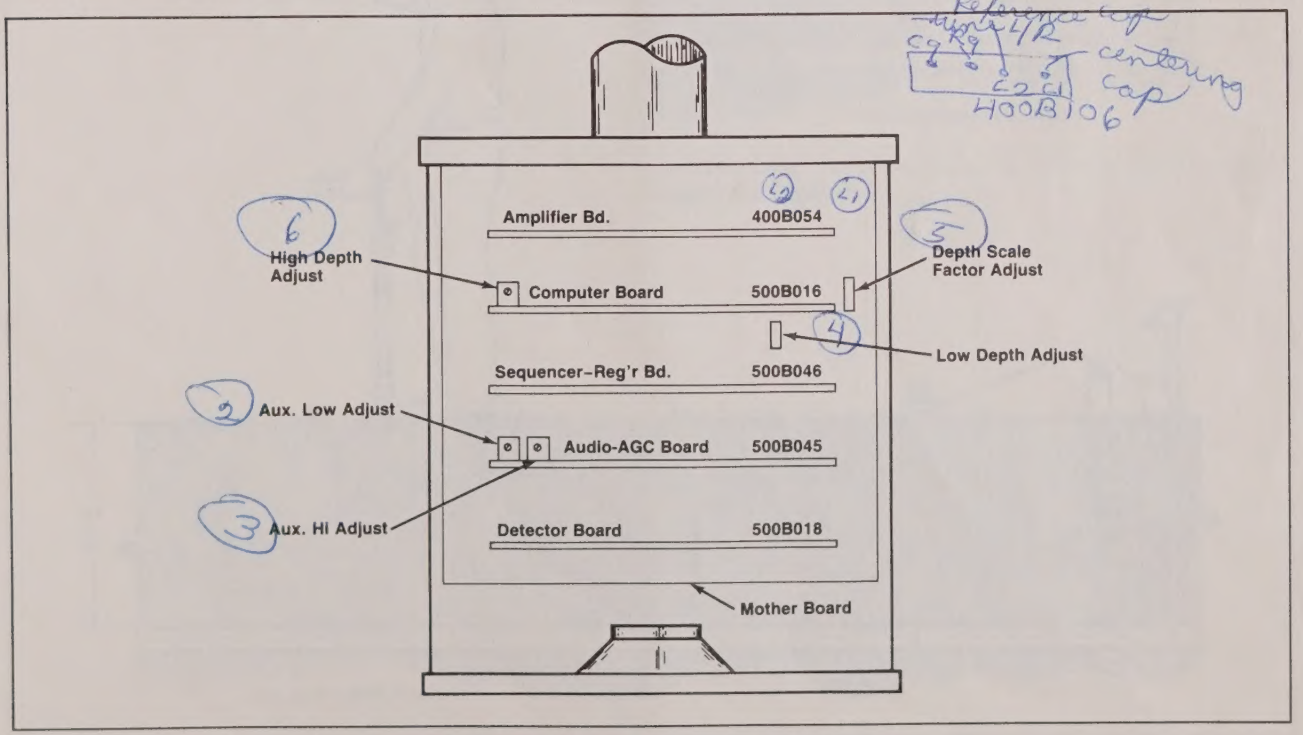

Figure 4 Location of Receiver Adjustments.

should be at least for 4 ft in height

1. Switch the Transmitter ON and position it over the "known buried conductor" at one end of the test section. Use the Transmitter in the direct (preferred) or inductive mode.
2. Set the LOW DEPTH ADJustment (4 in Figure 4) so that the arrow points to a ~~10 o'clock~~ position.
3. Position the Receiver over the buried conductor (see Figure 5) to make a reading. If the Inductive method was selected in Step 1, move at least 60 feet along the conductor.
4. Make a position test using the LEFT/RIGHT meter. The Receiver antenna should be exactly over the buried conductor, with no audio tone.
5. Press the DEPTH button. The Receiver should indicate the depth of the conductor within ±10%.
6. If the reading is not within the limit, adjust the DEPTH SCALE FACTOR control (5 in Figure 4) until the required reading is obtained.
7. Place the Receiver antenna on the wooden ladder or platform (see Figure 5) at least 2 feet higher than ground level, and press the DEPTH button. If the depth reading on the Receiver does not match the known depth plus the height of the platform, adjust the HIGH DEPTH control (1) until it does.
8. Repeat Steps 4 through 7 to recheck the depth calibration.
9. Replace the original Receiver cover.

NOTE

If this procedure fails to set the instrument within the limit of ±10%, return the Receiver and Transmitter to the factory for repair.

See also "Factory-Authorized Service" in Section 1 of this manual.

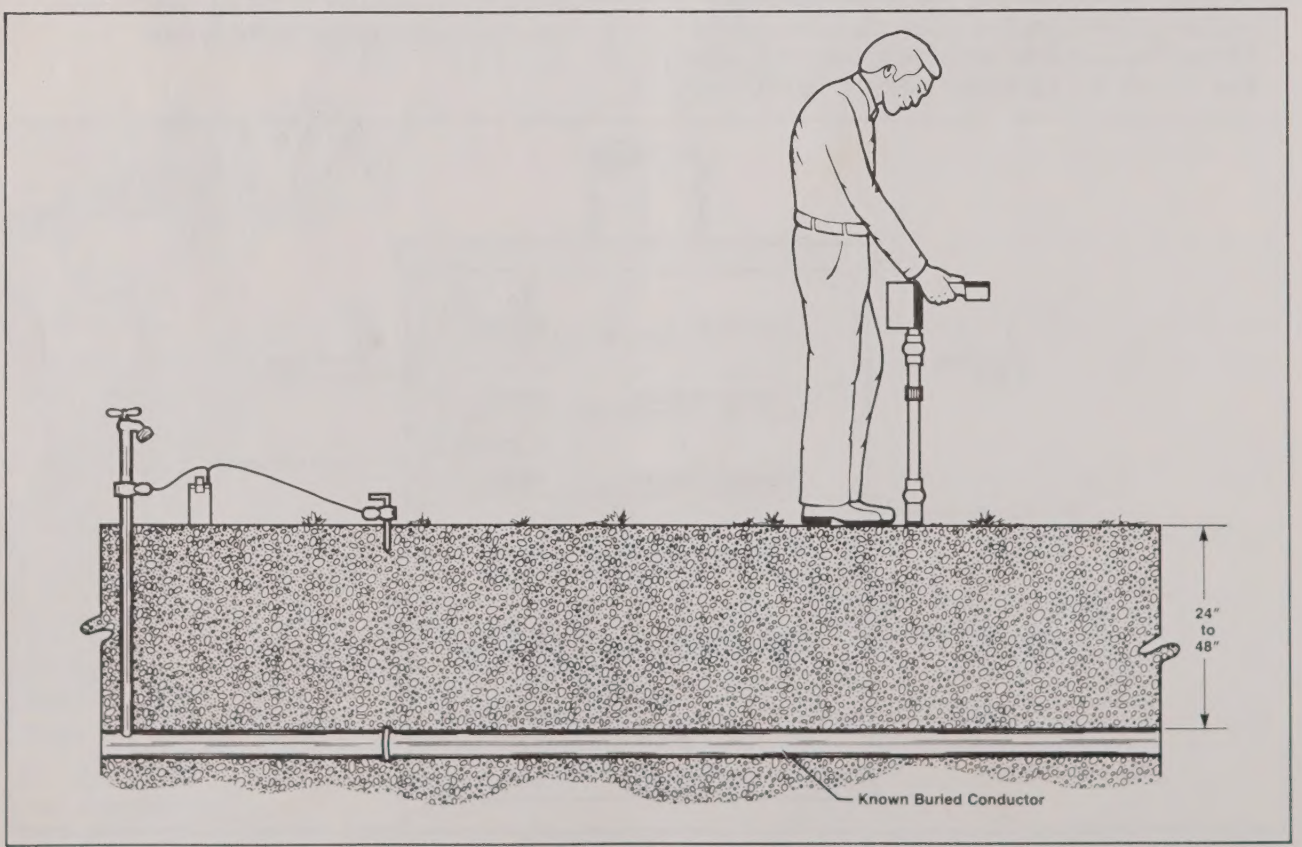

Figure 5 Depth Calibration.

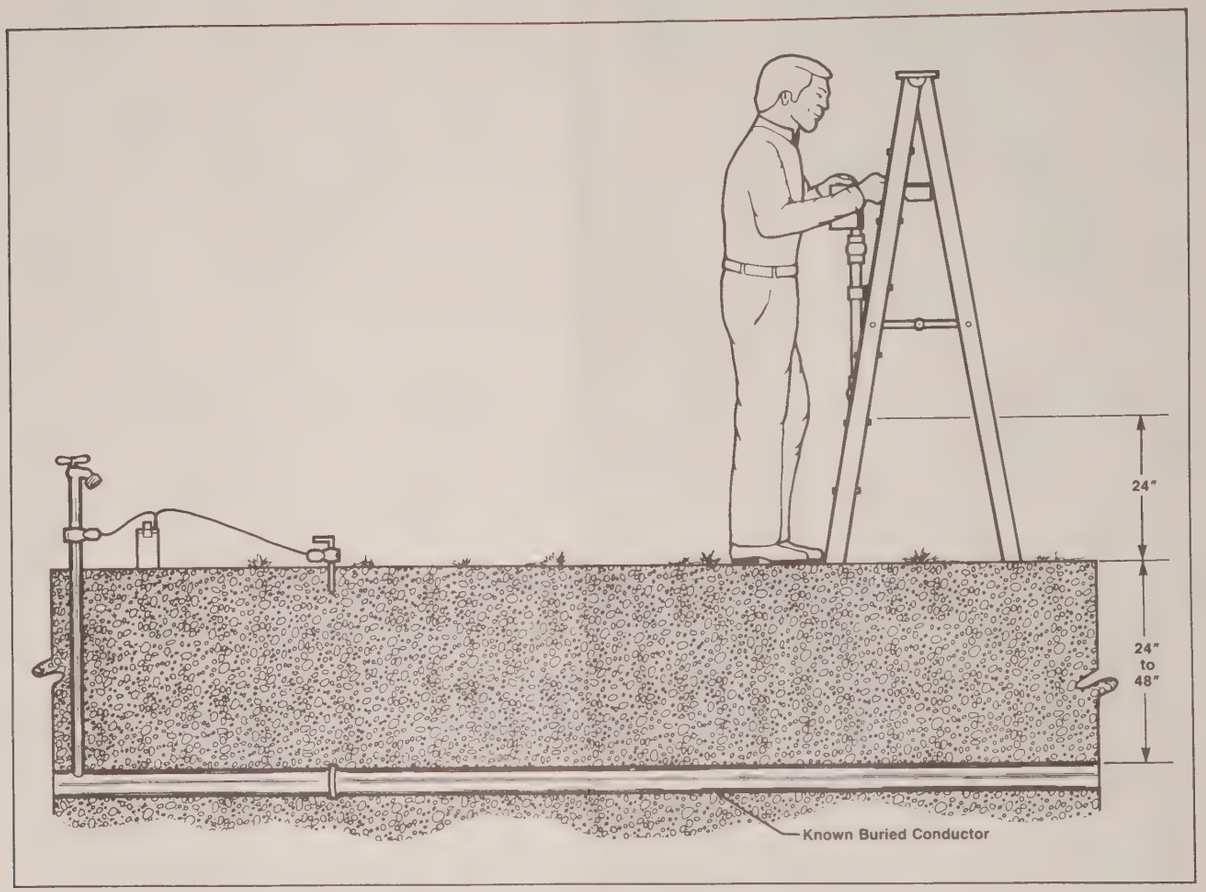

Figure 6 Second Depth Calibration.

1.	500B018	Detector/Meter Board
2.	500B045	Audio/AGC Board
3.	500B046	Sequencer/Regulator Board
4.	500B016	Computer Board
5.	400B054	Amplifier Board
6.	400B047	Receiver Cover with Pad
7.	112453	Receiver Knob
8.	162428	Headphone Jack
9.	500A043	Rotary Switch
10.	162427	AUX Jack
11.	400C058	Mother Board with Jacks and Switch
12.	500A024	Speaker
13.	500C008-1	Front Molded Panel
14.	500A276	Front Panel Decal
15.	162541	Depth Button
16.	162542	Depth Button Mounting Hardware
17.	162437	Battery 9V Alkaline
18.	500A244	Display Decal
19.	400B090	Battery Connector (Switch Side)
20.	400B091	Battery Connector (Jack Side)
21.	112535	Battery Door Latch
22.	400A008	Display Cable
23.	500A057	LCD Window
24.	500A148	Display Bezel
25.	400B053	Display Module
26.	162442	Left/Right Meter
27.	500A248	Foam Block
28.	500B013	Display Cover
29.	~~400C029~~ 400C100	Receiver Stem

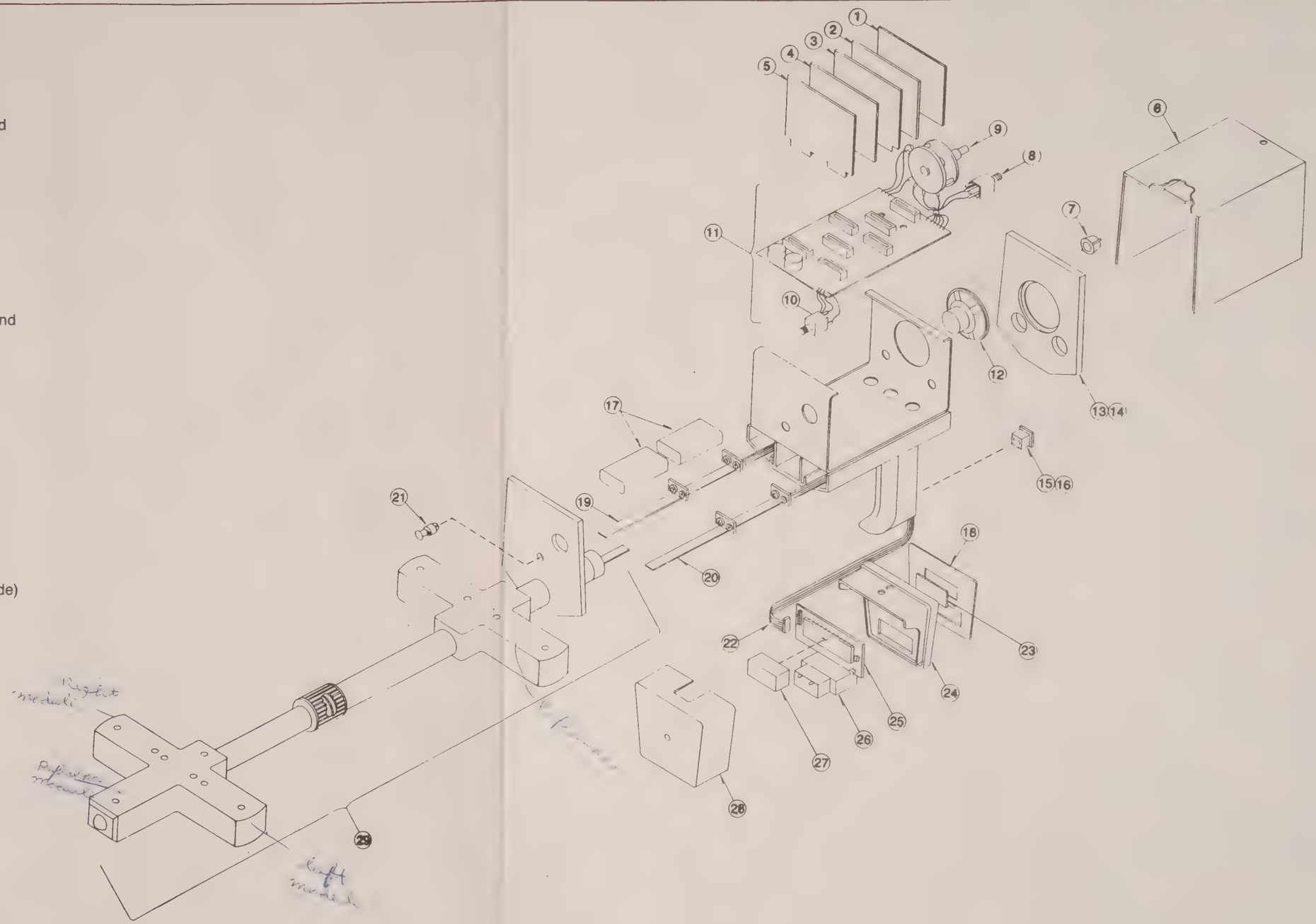

Figure 7 Receiver Illustrated Parts Breakdown.

1. 400B112 Panel with Hinge and Handle
2. 162500 Power Test Lamp
3. 162436 Power Test Switch
4. 162285 Push-Pull Switch
5. 400B023 Mother Board Assembly
6. 400B026 Transmitter Module Board
7. 800A019 Direct Jack Kit
8. 400B034 Battery Hold-Down Kit
9. 162438 Battery 1.5V Alkaline
10. 400B035 Battery Cradle
11. 112502 Transmitter Case Catch
12. 400C027 Transmitter Case with Antenna

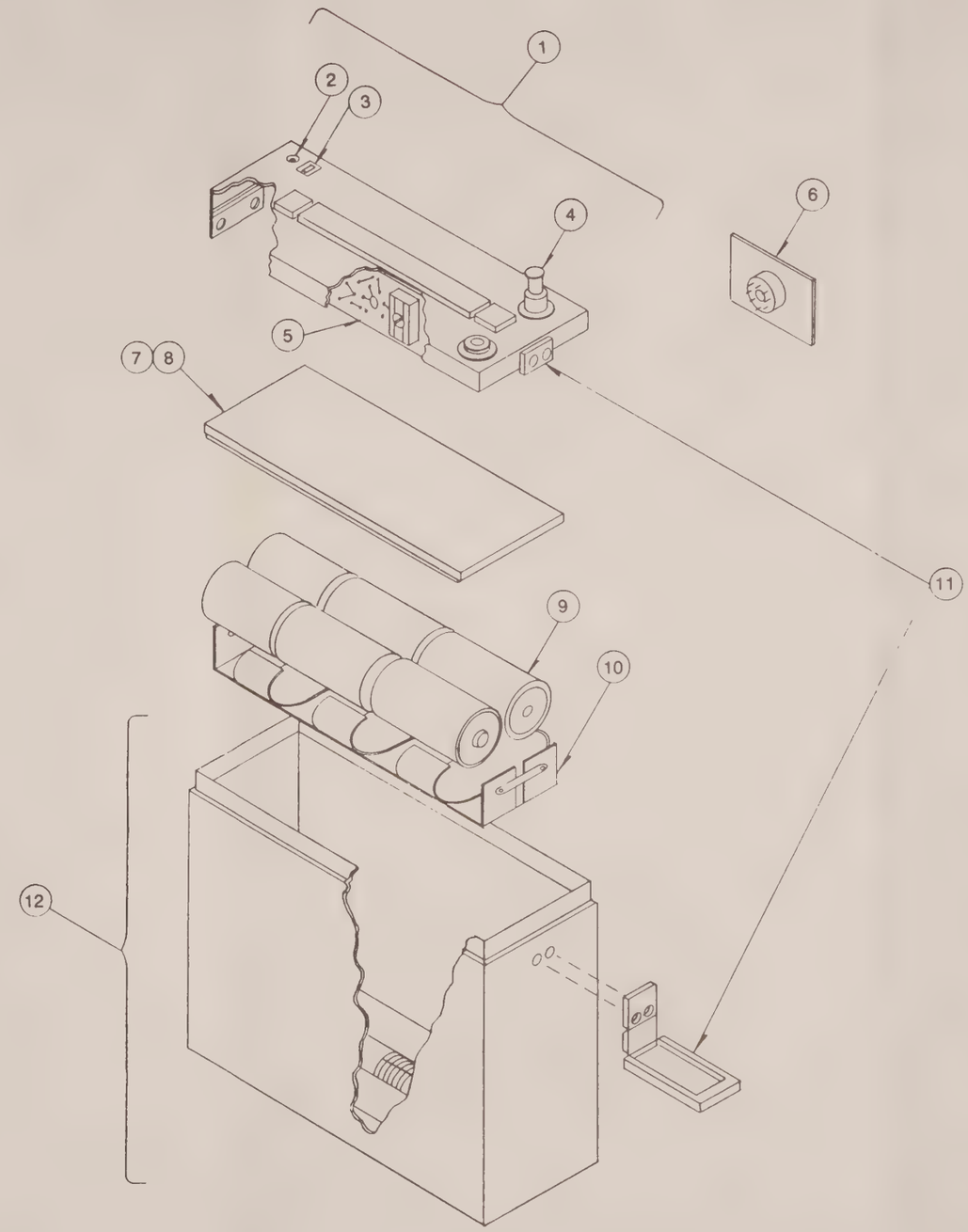

Figure 8 Transmitter Illustrated Parts Breakdown.

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MANUAL PART NUMBER: 600A045

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SECTION 11

810A Tuning and Calibration
S/N 3735 and Up

ANTENNA TUNING

This procedure tests and aligns the receiver on a test bench with pre-tested boards, prior to field testing. These are separate tuning procedures for the model 810 (black sensor housings). If the receiver has been checked against the criteria on the previous page and is still not operating properly, the tuning and calibration should be performed per this procedure:

Equipment Required

Dual channel scope with 5mv sensitivity and minimum of one microsecond sweep, external trigger desirable. Metrotech designed Uniform Magnetic Field Generator, dual and single connector extension PCB with test points.

REFER TO FIGURE 5-1 EQUIPMENT SET-UP

Check power supplies: J-E pin 6 and F = 9 vdc; pins A +5.5 and C -5.5 = +and- 5.5 vdc.

Remove receiver housing cover. Remove upper and lower button housings. Insure transmitter batteries are good. Turn Transmitter on.

Insert receiver in test fixture as shown (Figure 5-1), making sure the stem is fully collapsed. Receiver should be flat on surface of test fixture.

Adjust the "offset" pot on the motherboard (250K left-hand) to minimum counter-clockwise. Adjust the scale-factor pot (10K right-hand) to mid-range.

Insert Amplifier (400B054), Sequencer/Regulator (500B046), and Detector/Meter (500B018) circuit boards into receiver and set mode switch to "batt test". Observe that the meter needle is above the battery test mark. Set mode switch to AUX position. Set test switch on test fixture to "NORM" position.

Connect scope with X 1 probe to the Top Sensor output on the motherboard - first resistor beside white wire - (Figure 5-2) and rotate the top sensor trim cap (Figure 5-7) C1 on the 400B043 PCB a full 360 degrees and note 2 peaks. If only one peak is present, remove C3 and repeat. Adjust C1 for maximum signal (minimum acceptable signal level is 74mv).

Connect scope input Channel A with a X 1 probe to Reference Sensor output wire on the receiver motherboard (blue wire) and external trigger the scope from the signal source output of transmitter. Rotate the reference sensor trim cap (C9) on the 400B106 PCB, a full 360 and note 2 peaks. If only one peak is noted, remove (C11) and repeat. Adjust (C9) for maximum output - signals should be the same phase.

Adjust the reference gain pot (R9) on the 400B106 PCB, so that the reference and top signals are identical in amplitude. It may be necessary to slightly adjust the reference trim cap (C3) on the 400B106 PCB, to match the top and reference phrase relationship exactly.

Attach the scope to the left/right sensor on the receiver motherboard (feed through next to coil card) JA pin E on amplifier card, (Figure 5-2). Move test switch to the left/right position. Adjust left/right trim cap (C2) on the 400B106 PCB to maximum. Signal should be at least 400 mv. Check to make sure signal moves equally left/right, if not adjust C-1.

Test fixture in normal, place Detector/Meter PCB (500B018) on single connector extender card. Attach jumper wire from input pin 2 to ground. Adjust R27 on Detector/Meter board (center pot) to center the left/right needle on meter. Remove jumper and extender card and reinstall Detector/ Meter PCB.

Place Amplifier PCB (400B054) on double connector extender card. Attach black lead of Manual AGC Generator (400B112) to JA-A and red lead to JA-B of extender card. Attach scope channel A to JB-5. Attach scope Channel B to Top/Reference output JB-6 on extender card. Adjust Manual AGC Generator until left/right and reference signals are approximately 1 volt.

Adjust reference transformer. T1 on motherboard, for maximum output on Channel B. Signal is a nice sinewave.

Test fixture in left/right. Adjust left/right amplifier transformer, T2 on motherboard, for maximum output on Channel A. When adjusting the motherboard transformers, the Manual AGC Generator may need to be adjusted in order to display waveforms on scope. Signal is not a perfect sinewave.

Remove manual AGC and install AGC PCB (500B045).

Remove extender card and install amplifier PCB (400B054) into motherboard. Move test switch to "Normal" position. Install upper and lower housings.

With a non-metallic screwdriver, adjust the centering trim can (C1) on the (400B106) PCB to center the left/right meter.

The unit is now ready for sealing and field calibration.

810A TRANSMITTER TUNING (S/N UP TO & INCLUDING 3734)

output freq = 83.0775 KHz ± 213

1) With the Tx placed at least 1 foot (30 cm) away from any sheet metal surfaces or tuned circuits (antennas, etc.) resonant at or near 83 KHz, unlatch and fold back the top hinged panel, and place multimeter across the terminals of the push-pull POWER SWITCH (with the switch in the off position). Its meter switch settings range should be approx. 0-150 ma D.C.

2) Tune the Inductive output circuit by adjusting the compression mica trimmer,(figure 3-1),for minimum current, which should be 30-45 ma.

3) Tune the DIRECT output circuit by inserting an ordinary phone plug (nothing connected) into the DIRECT Jack, then adjust (by hand) the outer cup portion of the ferrite cup core assembly on the mother board for minimum current, (figure 3-1), which should be 30-45 ma. (core must have 2 minimum points which will show identical values).

4) If 3) is done correctly, the current will be less than 115 ma. if the test plug is temporarily shorted.

5) It is advisable to make this further test of the transmitter and POWER TEST lamp calibration:

Temporarily remove a cell from each row and connect a variable power supply to the battery contacts (with positive to the red terminal on the right). With the multimeter connected across the POWER switch as above the supply set at 7.0 volts, the POWER TEST lamp should glow when the TEST button is pressed, whether in the Inductive (step 2) or DIRECT (step 3) mode. At approximately 5 volts, the lamp should not glow.

If there is trouble in any of the Tx tests, recheck the tuning steps and, if necessary, try substituting the Tx module.

810A TRANSMITTER TUNING (S/N 3735 & ABOVE)

1) With the Tx placed at least 1 foot (30 cm) away from any sheet metal surfaces or tuned circuits (antennas, etc.) resonant at or near 83 KHz, unlatch and fold back the top hinged panel, and place multimeter across the terminals of the push-pull POWER SWITCH (with the switch in the off position). Its meter switch settings range should be approx. 0-150 ma D.C.

2) Tune the Inductive output circuit by adjusting the compression mica trimmer,(figure 1-1), for minimum current, which should be 65-105 ma.

3) Tune the DIRECT output circuit by inserting an ordinary phone plug (nothing connected) into the DIRECT Jack, then adjust (by hand) the outer cup portion of the ferrite cup core assembly on the mother board for minimum current, (figure 1-1), which should be 30-45 ma. (core must have 2 minimum points which will show identical values). lowest possible reading

4) If 3) is done correctly, the current will be less than 115 ma. if the test plug is temporarily shorted.

5) It is advisable to make this further test of the transmitter and POWER TEST lamp calibration:

Temporarily remove a cell from each row and connect a variable power supply to the battery contacts (with positive to the red terminal on the right). With the multimeter connected across the POWER switch as above the supply set at 7.0 volts, the POWER TEST lamp should glow when the TEST button is pressed, whether in the Inductive (step 2) or DIRECT (step 3) mode. At approximately 5 volts, the lamp should not glow.

If there is trouble in any of the Tx tests, recheck the tuning steps and, if necessary, try substituting the Tx module.

crystal - 2. ~~568~~ 658 KHz.

output freq 83.0775 khz ± 2hz JM 3-30-94

output power is checked with Aux

CAUTION
CHANGES HAVE B... E
ON THIS P...
SEE ISSUE SHEET

GENERAL

This procedure should be performed when one of the tests in Section 1 indicate that the instrument requires calibration, or a part has been replaced. Perform this procedure on the "known buried conductor" using the wooden step ladder or wooden platform for the second depth calibration test.

This test is performed with the Receiver cover replaced by Test Cover 300B038 to allow access to the adjustable components. Use a small slotted screwdriver to make the adjustments.

THE AUXILIARY CALIBRATION PROCEDURE

1. Take off the Receiver cover (Item 6 in Figure 7) by removing two phillips-head screws, and pulling off the battery access cover.

2. Install the Test Cover (300B038) with one screw. Close and latch the battery access door.

3. Connect the Receiver and Transmitter using the Auxiliary Cable (300A046). Insert the cable end "R" into the Receiver AUX INPUT jack. Insert the cable end "T" into the Transmitter DIRECT OUTPUT jack.

3A. Set receiver and transmitter to max. distance apart with cable connected.

4. Set the Receiver control to the AUX mode position. Point the Receiver away from the Transmitter.

5. Turn the Transmitter ON.

6. The Receiver should indicate 450. If not, adjust the AUX LO control (2 in Figure 4) until it does.

7. Remove the Auxiliary Cable from the Receiver and the Transmitter.

8. Set the Receiver and Transmitter 2 feet apart, as shown in Figure 3.

9. Adjust the AUX HI control (3 in Figure 4) for a reading of 975.

NOTES

1. Some early Model 810 instruments do not have an AUX HI control, or the control is located on the back of the Audio AGC module.

2. Leave the Test Cover on the Receiver and perform the Depth Calibration Procedure.

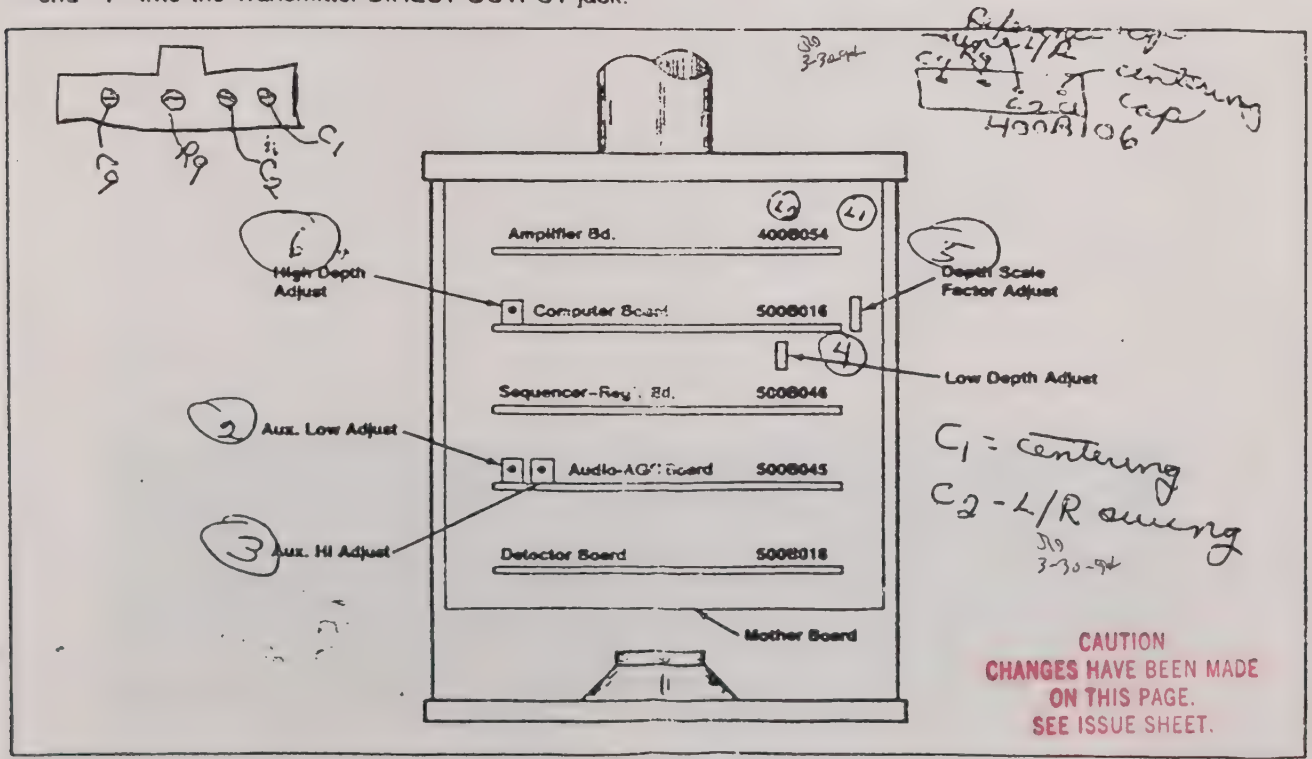


Figure 4 Location of Receiver Adjustments.

1. Switch the Transmitter ON and position it over the "known buried conductor" at one end of the test section. Use the Transmitter in the direct (preferred) or inductive mode.

2. Set the LOW DEPTH Adjustment (4 in Figure 4) so that the arrow points to - CCW position depth factor pot-CW position.

3. Position the Receiver over the buried conductor (See Figure 5) to make a reading. If the inductive method was selected in Step 1, move at least 60 feet along the conductor. Put Receiver directly on cable adjust low depth for 000.

4. Make a position test using the LEFT/RIGHT meter. The Receiver antenna should be exactly over the buried conductor, with no audio tone. Adjust C1 on B106 board for center reading when over cable.

5. Press the DEPTH button. The receiver should indicate the depth of the conductor within +/1 10%.

6. Receiver should be above 60 inches when doing high depth.

7. Place the Receiver antenna on the wooden ladder or platform (See Figure 5) at least 2 feet higher than ground level, and press the DEPTH button. If the depth reading on the Receiver does not match the known depth plus the height of the platform, adjust the HIGH DEPTH control (1) until it does.

8. Repeat Steps 4 through 7 to recheck the depth calibration.

9. Replace th original Receiver cover. within the limit of +/- 10%, return the Receiver and Transmitter to the factory for repair.

See also "Factory-Authorized Service" in Section 1 of this manual.

If this procedure fails to set the instrument within the limit of +/- 10%, return the Receiver and Transmitter to the factory for repair.

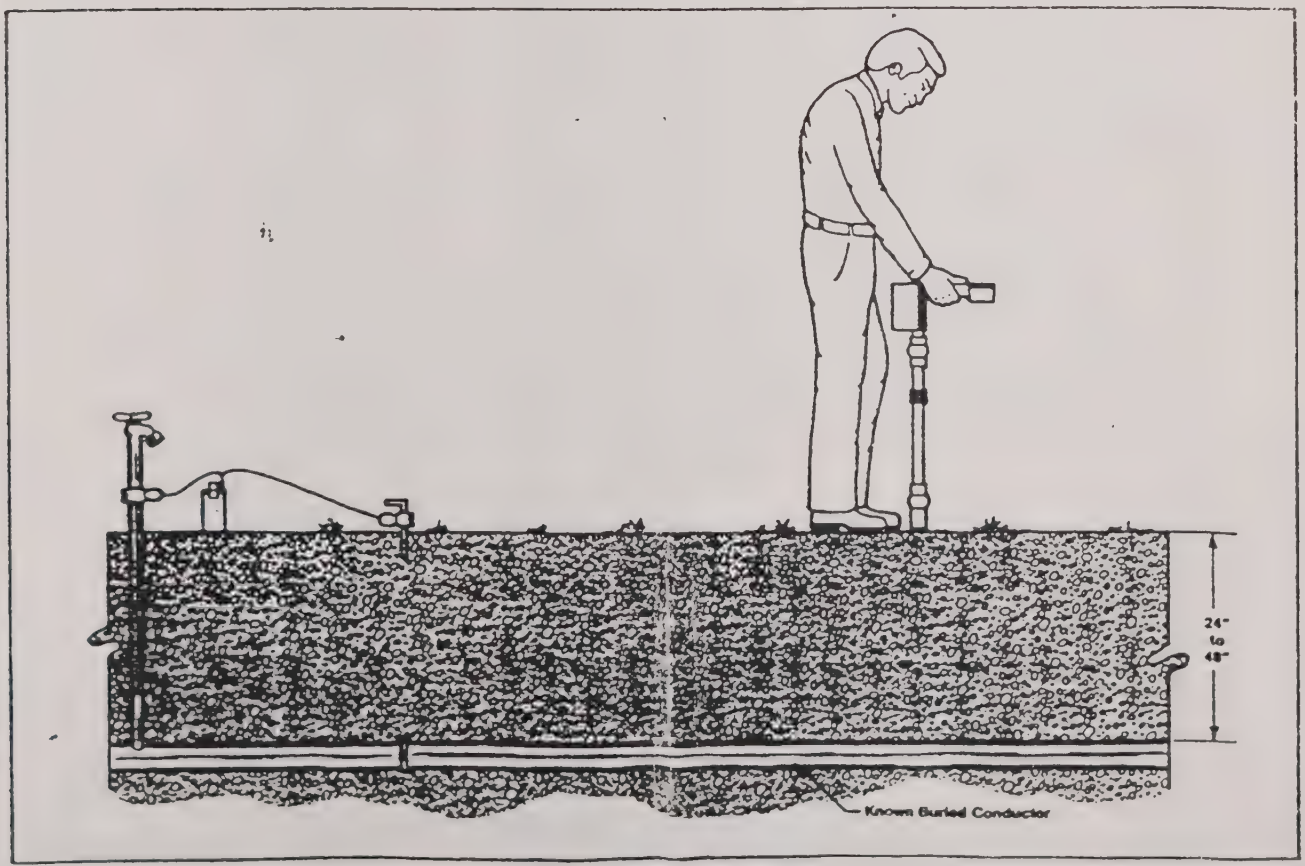


Figure 5 Depth Calibration.

CAUTION
CHANGES HAVE BEEN MADE
ON THIS PAGE.
SEE ISSUE SHEET.

METROTECH

670 National Avenue
Mountain View CA 94043
415 965-9208 Telex. 171408

MODEL 810
Effective July 7, 1986

PART NO.	DESCRIPTION
	MAJOR ASSEMBLIES
400C021	Receiver, Complete Ass'y
400C022	Transmitter, Complete Ass'y
800B004	Conductive Attachment
400C079	Custom Fitted Carrying Case
ABOVE ITEMS SOLD FOR REPLACEMENT ONLY	
	RECEIVER ASS'Y AND PARTS
162437	Battery, Alkaline NEDA 1604A 9V (4 req'd)
400B090	Battery Connector, Jack Side Ass'y
400B091	Battery Connector, Switch Side Ass'y
500A058	Bumper, Spkr. Mount 5/16" dia. (4req'd)
400A008	Cable, Display Interconnect Ass'y
500B046	Circuit Board, Regulator/Sequencer Ass'y
400B054	Circuit Board, Amplifier Ass'y
500B016	Circuit Board, Computer Ass'y
500B045	Circuit Board, AGC/Audio Ass'y
500B018	Circuit Board, Detector/Meter Ass'y
400B053	Circuit Board, Display w/LCD Ass'y
500A095	Collar Extension, Nylon
500B013	Cover, Display Module, Orange, Ass'y
400B047	Cover, Electronics Orange, Ass'y
200A001	Cover, Special w/Alignment Holes
162427	Jack, Aux/Input
162428	Jack, Headphone
112453	Knob, Black
112535	Latch, Nylatch, Black (Batt.Access Door)
162442	Meter, Edgewise, Center Zone
500A060	Pad, Battery, Gray 2-1/4" X 1 X 3/4"
500C008-1	Panel, Front Elect. Housing, Molded
500A276	Plate, Front Electronics
500A244	Plate, Trim, Display Module
500A024	Speaker, 2" rd, Mylar Cone
162436	Switch, Depth Momentary
500A043	Switch, Rotary Mode
500A057	Window, LCD Display
* ~~400C024~~ 400C100	Assy, AUX w/ BASE
500D026	FOAM INSERTS,810/850 CARRYING CASE,UPPER
500D027	FOAM INSERTS,810/850 CARRYING CASE,LOWER
400A092	AUX PCB
nemo810	

39.

1 of 2

PART NO.	DESCRIPTION

TRANSMITTER ASS'Y AND PARTS

162438	Battery, Alkaline 1.5V (6 req'd)
400B035	Battery Cradle, Ass'y
400B034	Battery Holdown Plate w/pad, Ass'y
500A155	Bracket Switch Protector
400C027	Case, Transmitter Orange, Ass'y
112502	Catch, Trans. Case
400B026	Circuit Board, Transmitter Module, Ass'y
800A019	Jack, Direct - KIT
162500	Lamp, Power Test w/Washer
400C032	Panel, Transmitter w/Hinge,Catch,Handle
162285	Switch, Push/Pull
162436	Switch, Power Test
162486	Switch Toggle, A-B Load
112452	Handle

4820 METROCLAMP COUPLER

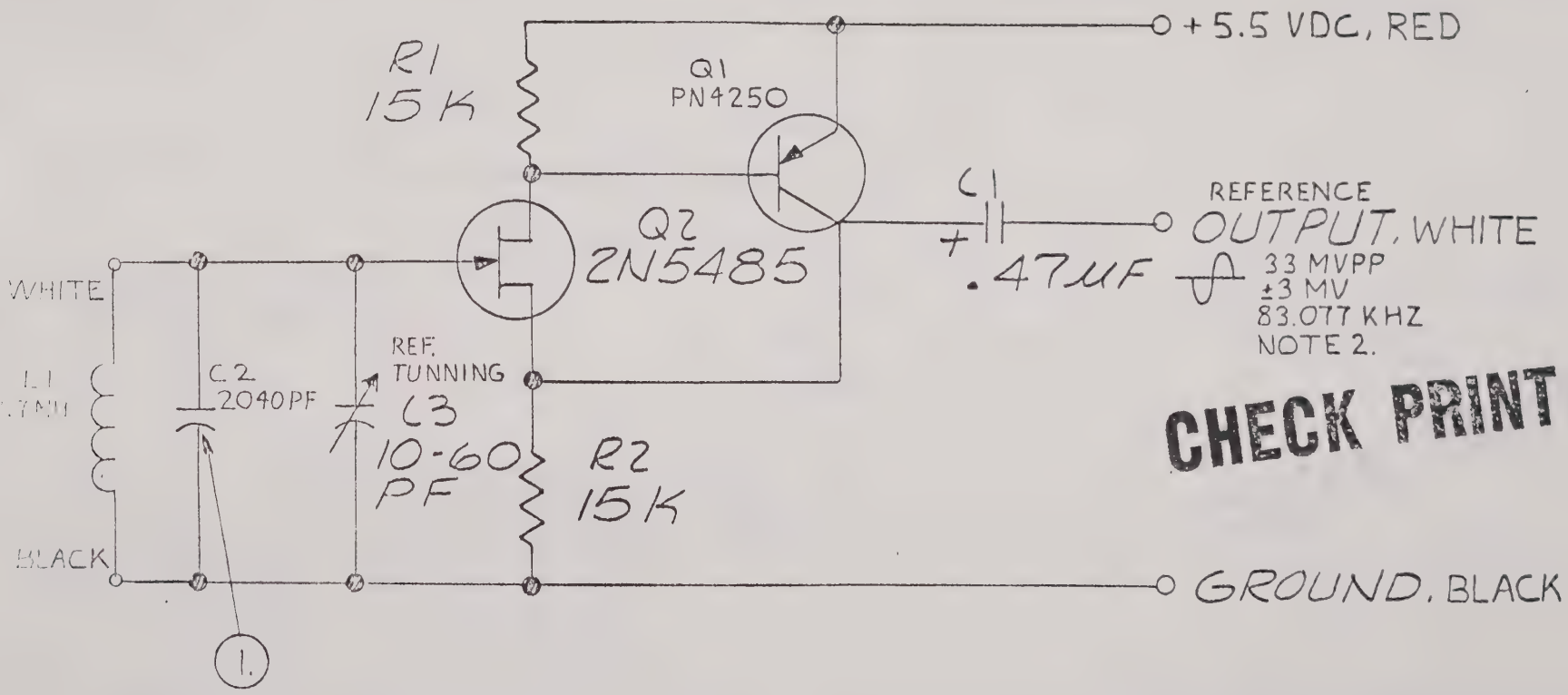
400B005	Cable w/Plug
500A054	Cover, Access Label
500A051	Pin Pivot
500A052	Spring, Torsion
400A005	Ass'y Cable Jumper

162494 IS THE SAME AS 800A019 UNASSEMBLED pe 9/24

ALL SHIPMENTS F.O.B. MOUNTAIN VIEW, CA
MINIMUM BILLING $45.00
ALL RETURNS MUST BE AUTHORIZED BY THE FACTORY
MINIMUM RESTOCKING CHARGE 15%
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

400A011	REFERANCE AMP
400A012	ACTIVE AMP
400A013	PASSIVE AMP
400A014	TOP AMP

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



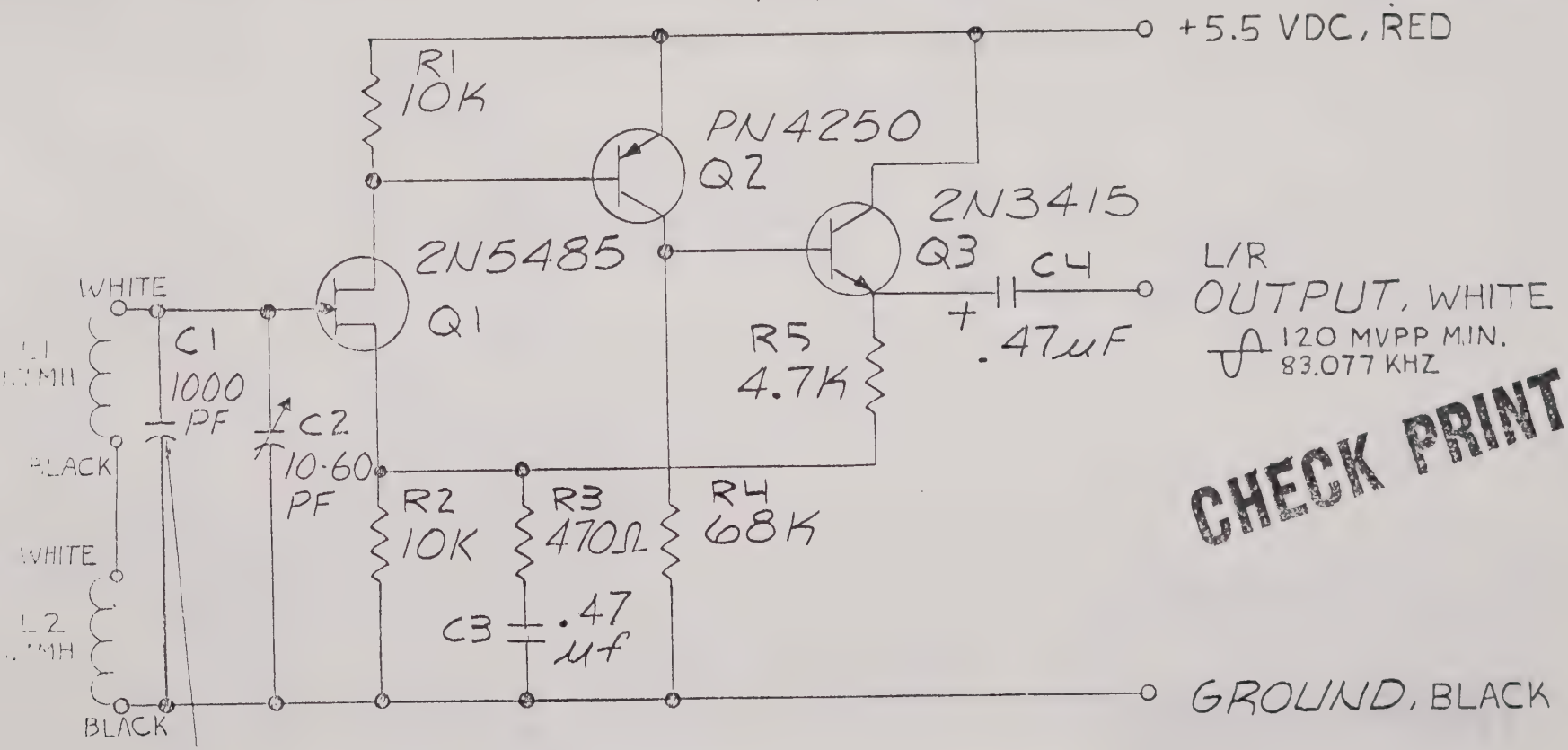
CHECK PRINT

Note: 1. On Model 850
a cap. Disc 39pf (C4)
added Parallel to C2

2. THE REF. OUTPUT MUST BE 3 MV LOWER THAN TOP OUTPUT.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		METROTECH Underground Locator Products		
APPROVALS	DATE	SCHEMATIC, PREAMP, REF		
				810/850
DRAWN				
CHECKED MMS	6/9/82	SCALE	SIZE A	DRAWING NO. 100A002
		DO NOT SCALE DRAWING		SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	UPDATE 7-8-82	7-8-82	[illegible]

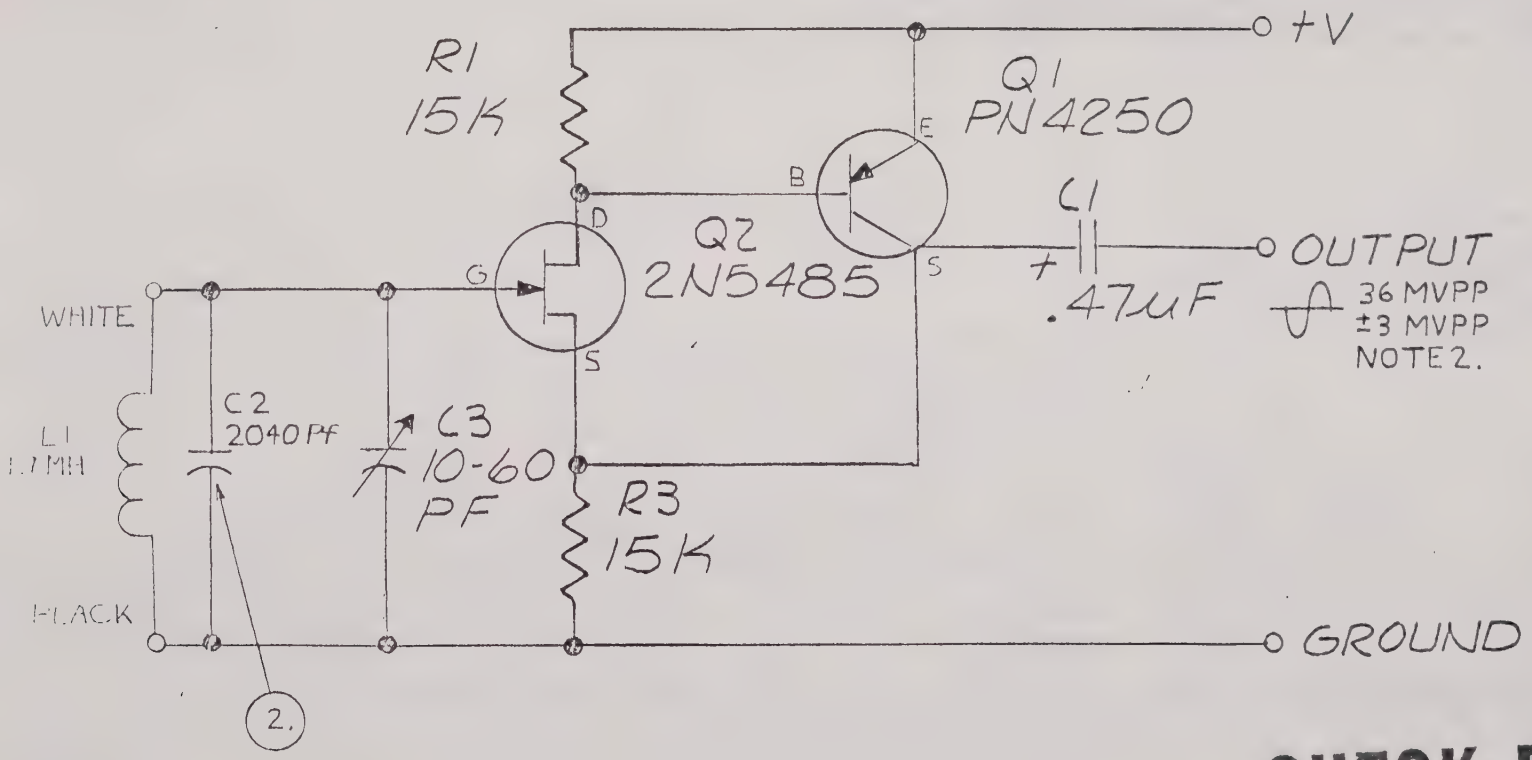


CHECK PRINT

Note: On Model 850
C1 is replaced by three
Capacitors in Parallel
1- 390 Pf Poly
1- 560 Pf Poly
1- 25 Pf Cer Disc

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		METROTECH Underground Locator Products	
APPROVALS	DATE	SCHEMATIC, PREAMP, L/R (ACTIVE)	810/850
DRAWN			
CHECKED MMS	6/9/82	SCALE	SIZE A / DRAWING NO. 100A003
		DO NOT SCALE DRAWING	SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	DELETE R2 500Ω POT	6-9-82	AP



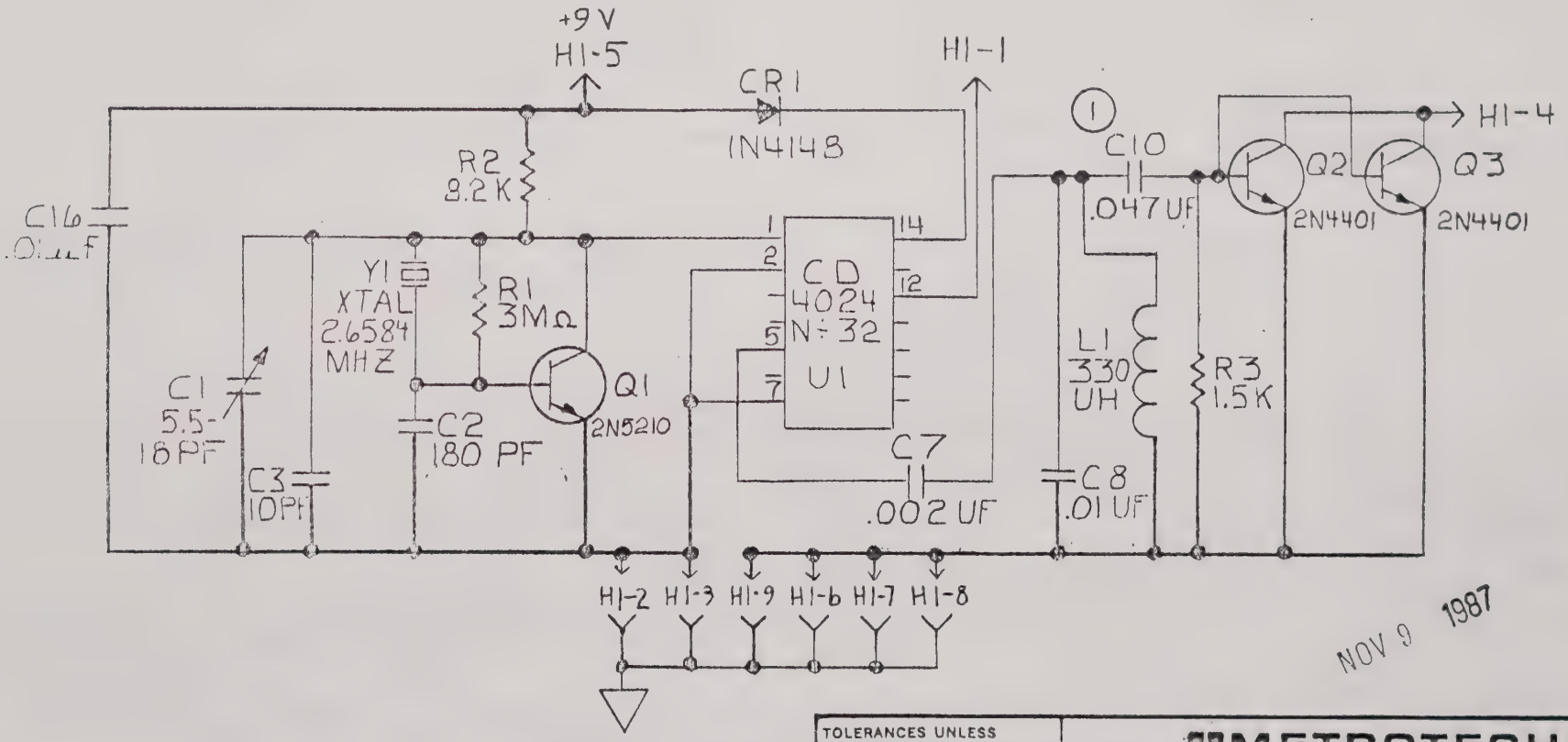
CHECK PRINT

Note: 1. On Model 850
a CAP. Disc 39 Pf (C4)
added Parallel to C2
2. THE OUTPUT MUST BE 3 MV
HIGHER THAN THE REF. OUTPUT.

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		METROTECH Underground Locator Products		
APPROVALS	DATE	SCHEMATIC, PREAMP, TOP		810/850
DRAWN				
CHECKED MMS	6/9/82	SCALE —	SIZE A	DRAWING NO. 100A004A
		DO NOT SCALE DRAWING		SHEET 1 OF 1

FAB: 500A047
ARTWORK:
ASSY: 400A051 (810)
400A061 (850)

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	DOCUMENTATION CLEAN UP	5-6-85	
B	TRAN. CHANGE AS PER ECN 143	9-26-85	
C	C2 AND ART CHANGE, ECN 344	11-5-86	DS 1/13/87



FAB-500A026
ARTWORK-500A294
ASSY.-400B026

LAST USED: HI, LI, CRI, YI, UI, Q3, R3, C16
NOT USED: C4, C5, C6, C9, C11, C12, C13, C14, C15

TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTIONS	DEC	ANGLES
±	±	±

APPROVALS	DATE
DRAWN Bruce Pt	5-6-85
CHECKED	1/13/87

METROTECH
Underground Locator Products

SCHEM., MODULE BD., XMTR.

810/810A

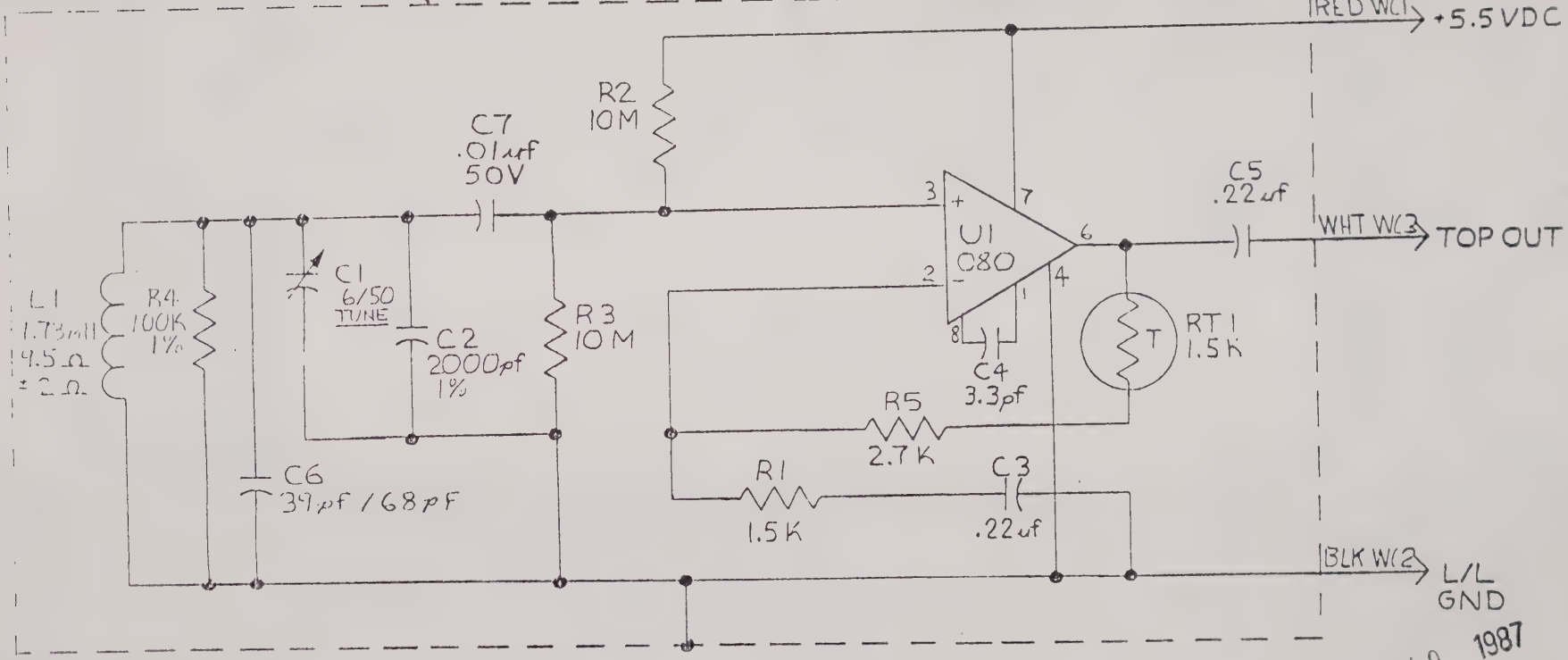
SCALE	SIZE	DRAWING NO.
N/A	A	100A010

DO NOT SCALE DRAWING — SHEET 1 OF 1

BISHOP GRAPHICS
BORDER NO. 20620

FAB: 500B058
ARTWORK: 500A131
ASSY: 400B111

REVISIONS				
E.C.N.	REV.	DESCRIPTION	DATE	APPROVED
209	A	REVISED & REDRAWN	9/9/85	JCN
223	B	C3 C5 SUB	10-1-85	



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NOTES:
1. ALL RESISTORS ¼ W, 5%.
2. L1 LOCATED OFF BOARD.
3. VOLTAGES PRESENT WHEN THE SENSOR HAS +5.5 VDC AND PLACED ON THE UNIFORM MAGNETIC FIELD GENERATOK AND ENERGIZED BY AN 810 TRANSMITTER.
4. FORMERLY 100A008 AS PER ECN 209.

P119	R-810
NEXT ASSY	USED ON
APPL TION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

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APPROVALS	DATE
DRAWN MV	11-28-85
CHECKED JCN	8-21-85
ISSUED	

METROTECH
Underground Locator Products

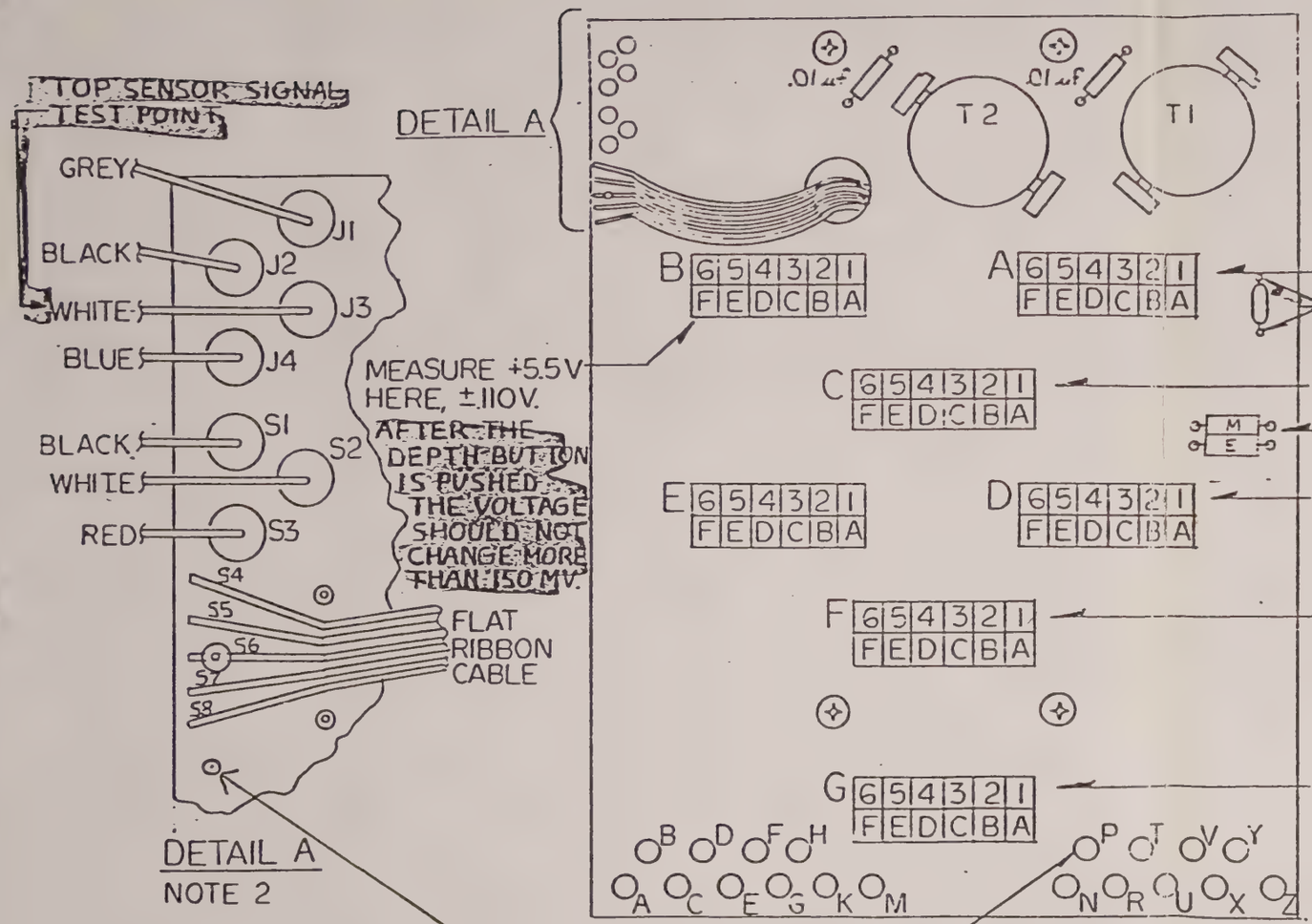
SCHEMATIC, R-810 TOP PREAMP. (VERSION I & II.)

SIZE	DWG. NO.	REV.
A	100A011	

SCALE -- SHEET 1 OF 1

GRAPHICS/AUTOPRESS

REVISIONS			
LTR	DESCRIPTION	DATE	A


TOP SENSOR SIGNAL TEST POINT
DETAIL A
GREY
BLACK
WHITE
BLUE
BLACK
WHITE
RED
J1
J2
J3
J4
S1
S2
S3
S4
S5
S6
S7
S8
MEASURE +5.5V HERE, ±.110V. AFTER THE DEPTH BUTTON IS PUSHED THE VOLTAGE SHOULD NOT CHANGE MORE THAN 150 MV.
FLAT RIBBON CABLE
DETAIL A
NOTE 2
LEFT-RIGHT
.01 uf
.01 uf
T2
T1
B 6 5 4 3 2 1 / F E D C B A
A 6 5 4 3 2 1 / F E D C B A
C 6 5 4 3 2 1 / F E D C B A
E 6 5 4 3 2 1 / F E D C B A
D 6 5 4 3 2 1 / F E D C B A
F 6 5 4 3 2 1 / F E D C B A
G 6 5 4 3 2 1 / F E D C B A
M
E
AMPLIFIER CARD 400B054
MEASURE AGC VOLTS HERE (0 TO -2.4 V)
COMPUTER CARD 500B015
NOTE ①
SEQUENCER-REGULATOR CARD 500B046
AUDIO-AGC CARD 500B045
DETECTOR CARD 500B018
MEASURE -5.5V HERE, ±.110V. AFTER THE DEPTH BUTTON IS PUSHED THE VOLTAGE SHOULD NOT CHANGE MORE THAN 150 MV.

NOTES:

① METRIC VERSION: PLACE 22 Ω RESISTOR IN "M" HOLES.
ENGLISH VERSION: PLACE 22 Ω RESISTOR IN "E" HOLES.

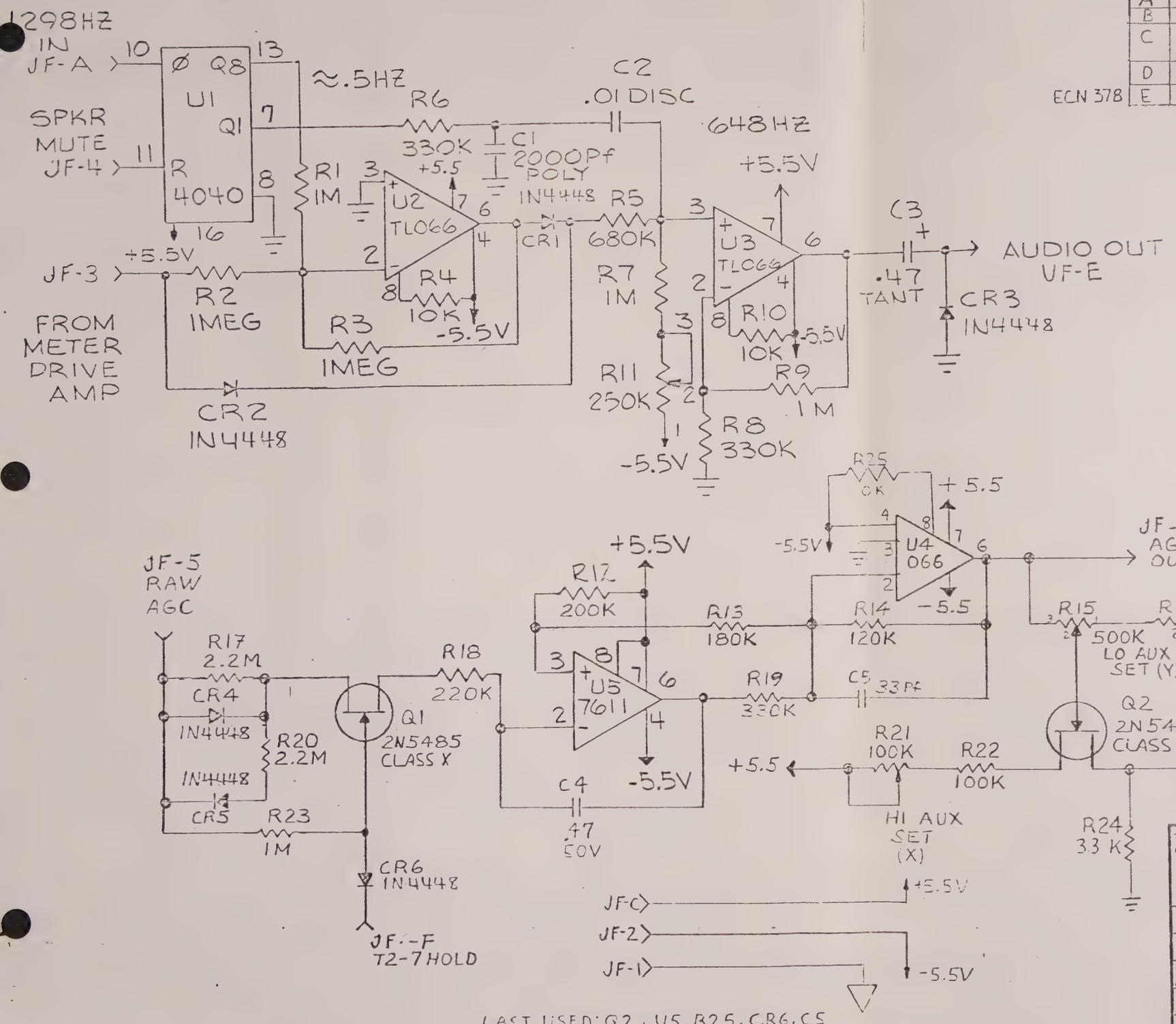
2. DETAIL A SIGNALS:
J1; GREY: L/R SIGNAL
J2. BLK: SIGNAL GND.
J3. WHT: TOP/REF. SIGNAL, AUX. INPUT MODE ONLY.
J4. BLUE: REF. SIGNAL
S1. BLK: SIGNAL GND
S2. WHT: TOP SIGNAL } TOP SENSOR
S3. RED: +5.5 V
S4: SHIELD GND
S5: REF. SIGNAL
S6: +5.5 V
S7: L/R SIGNAL
S8: SIGNAL GND. } FLAT RIBBON CABLE REFLEX SENSOR

FIGURE 5-2

TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		ASSY., PCB, MOTHER BD. VOLTAGE TEST POINTS 810 MANUAL	810/9
APPROVALS	DATE		
DRAWN JnV	1-26-85		
CHECKED		SCALE 2-1	SIZE B
		DRAWING NO. 600B001	
		DO NOT SCALE DRAWING	SHEET 1 of

CR GRAPHICS INC

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	UPDATE 7-8-82	7-8-82	JP
B	DOCUMENTATION CLEAN UP	2-2-85	ECN158
C	CHG. DIODES FROM IN4148 TO IN4448 ADD TRANS. CLASS. ECN 284	4-8-86	JAN
D	TRAN. CLASS REVISED FOR NEW TEST	2-19-87	JCN
ECN 378 E	CHANGE R16 FROM 680K TO 220 K	4-30-87	



NOV 9 1987

FAB - 500B017
ART WORK - 500B155
ASSY - 500B045

500B045	R-850A
500B045	R-810A
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN	
CHECKED	

METROTECH
Underground Locator Products

AUDIO AGC CKTS
(PLUG IN) BD.
810A,850A

SCALE	SIZE	DRAWING NO.
	B	100B017,

DO NOT SCALE DRAWING — SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	CHANGE R2 FROM 5.6K TO 5.6M	7-29-82	
B	ADDED R32 & C15		
C	R16 CHANGED FROM 3M TO 10M	2/6/85	ECN 155
D	C6 & C16 CHANGED FROM OR16 VALUE TO A 470 PF AS PER ECN 174	4-18-85	
E	ECN 155 OBSOLETE	8-20-85	
F	TRAN. CHANGE ECN 143	9-26-85	
G	REMOVE TP1, 2 & 3, ECN 288	5-14-86	JCN
H	ADD TP1, J1 & 2, ECN 295	8-4-86	JCN
I	ADD CAP. C20, ECN 410	9-9-87	

JG-3 REF AMP

.01 C1 +5.5 R2 5.6M 250K TRIM R1 3 2 3 U1 -5.5V

R3 47K

R4 10M SD213DE Q1

.002 C2 DISC R6 1M C3 .047 MYL

U1 7611 +5.5 7 8 6 2 4 -5.5

TP1 R5 1M

R7 56K R8 10M

90° CLOCK

+5.5 R9 250K TRIM U1 3

R10 5.6M

C8 .01μF R11 47K R12 120K R13 1M

C10 .01 -5.5V Q2 SD213DE

Q3 PN4250 2N5485 Q4

R16 3M C11 .47 -5.5

U2 066 +5.5 3 7 6 2 8 4 C9 .01μf R14 10K -5.5 R15

R20 100K 10K

CR2 IN4148 CR3 IN4148

CR4 IN4148

R21 820K +5.5V -5.5

R22 33K JP2 14 8

U4 S D Q CLK R Vss 9 13 11 12 10 7

6 C12 .47+

4013 S D Q CLK R 5 1 3 2 R32 27K 4

+5.5 C4 .47 R18 15K

Y1 2.6584 MHZ R17 3M Q8 X32

C6 220pf 10%

C7 .01μF DISC -5.5

C16 470 PF 10%

CR1 1SV50

C5 .47

JG-5, REF DC

+5.5 10 16 U3 4040 ØI VCC

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 9 7 6 5 3 2 4 13 12 14 15 1

RESET GND 11 8

JP1

JG-1

C17 100 PF

JG-D RAW AGC

C20 .01μF

"Y" SEE SHEET 2

JG-4 > +5.5V

JG-B > -5.5V

JG-A > ⏚

0° CLOCK

LAST USED: R32, C20, Q8, U5, CR4, Y1
NOT USED: R19, C18, C19

FAB - 500B197
ARTWORK - 500B156
ASSY - 810/500B018

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500B018	R-810A
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED		
FRACTIONS	DEC	ANGLES
±	±	±

APPROVALS	DATE
DRAWN	
CHECKED MAS	6/9/82
	7-26-84
	2/6/85

METROTECH Underground Locator Products

DETECTOR/METER

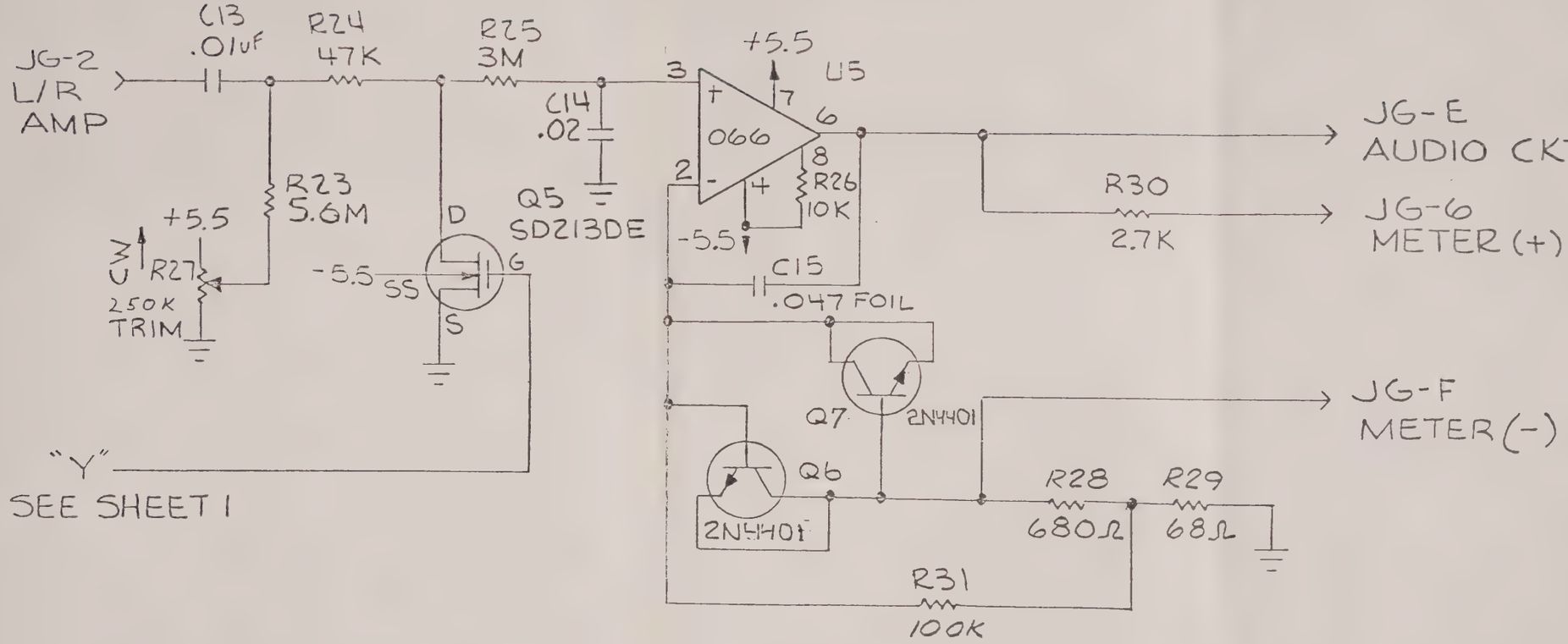
810A/810

SCALE | SIZE B | DRAWING NO. 100B020

DO NOnot SCALE DRAWING | SHEET 1 OF 2

ESHOP GRAPHICS INC
PLOTTER NO 20621

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	UPDATE 7-8-82	7-8-82	FP



		TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		METROTECH Underground Locator Products			
		APPROVALS	DATE	DETECTOR/METER 810/810A			
		DRAWN					
500B018	R-810A	CHECKED MWS	6/9/82	SCALE	SIZE B	DRAWING NO. 100B020	
NEXT ASSY	USED ON			DO NOT SCALE DRAWING		SHEET 2 OF 2	
APPLICATION							

BISHOP GRAPHICS INC.
REORDER NO 20621

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	UPDATE 7-8-82	7-8-82	
B	Added Load Matching Sw. Circuitry thru titled BICA	8/12/82	
C	REVISE PER ECN 284 REMOVED IMPEDANCE MATCHING SWITCH	10-1-84	
D	C4 & C6 CHANGED, ECN 231	10-14-85	JCN
E	CHANGE REF DESIG. ECN 303	7-31-86	
F	C2 AND ART CHANGED ECN 344	11-5-86	
G	C4 CHANGE ECN 370	2-24-87	

C4 220PF
C5 82 PF
W8
POWER TEST S2-A
P-1 POWER TEST
W7
C14 560 pf
L-2
C13 2000 PF
C15 560 PF
C11 .005 uf 200V 1%
L-3
C12 80-480 PF
N W2 POWER TEST S2-B W4 H
E D F
S1 W9 C
BATT SUPPLY 6 "D" CELLS + B
9VDC + 220uf C6
SK1-5
SK1-1
(1.329240 MHZ)
SK1-4
M W1
K W3-1
R W5
NC
A W6
DIRECT OUTPUT
J1
CR1
IN4448
C16 .01µf
R2 8.2K
1 C10 .047
Q2
Q3 2N3415
L1 330 µH
R3 1.5K
C3 C9 10PF XTAL 2.6584 MHZ
C2 180PF
R1 3MΩ
Q1 X32-7349
C1 5.5-18PF F6 ADJ
1 14 CD12 4024 N÷32 5 7 U1
C7 .002
C8 .01 uf
HI-SK1- 2 3 6 7 8 9

FAB-500B022
ARTWORK-500B153
ASSY-400B023

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400B023	T-810
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN	
CHECKED MWS	6/9/82
	1/13/87

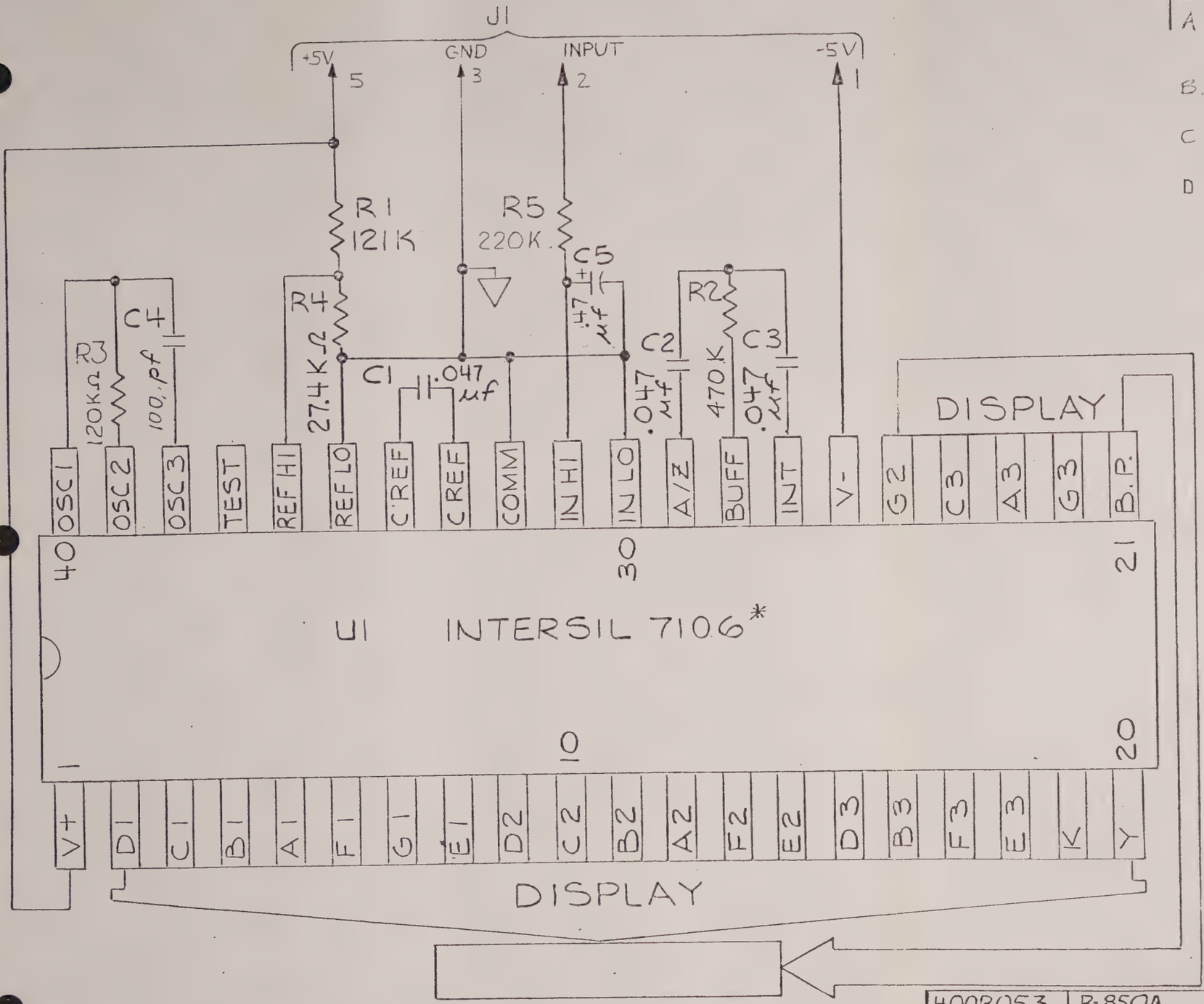
METROTECH Underground Locator Products

SCHEM, XMITER MOTHER BD. & MODULE BD.

SCALE | SIZE B | DRAWING NO. 100B022

DO NOT SCALE DRAWING | SHEET 1 OF 1

BISHOP GRAPHICS INC PROPRIETARY NO. 20621



*ALTERNATE: TELEDYNE 7126A

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	120Ω→180Ω, 99pf→47pf), 470K→1.5M (R3, C4, R2) 7106→7126	4.12.84	VJP
B.	ALTERNATE W/ 7106 & PINOUT VALUES	4.27.84	VJP
C	CHANGE R5 FROM 3M TO 220K & C5 FROM .047 TO .47 AS PER ECN #144		MV
D	C4 FROM 99 pf TO 100 pf. ECN 231	10-9-85	VJP

TRACE HOOK UP FROM IC TO LCD.

IC PIN #	LCD PIN #	IC PIN #	LCD PIN #
2	18	14	13
3	19	15	10
4	20	16	29
5	21	17	31
6	22	18	9
7	23	19	N/C
8	17	20	N/C
9	14	21	1-3,5-8,12,16 28, 34-40
10	15		
11	24	22	32
12	25	23	30
13	26	24	11
		25	27

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* SEE ECN 0094B FOR ALTERNATE, SUBJECT TO AVAILABILITY OF ICL7126.

ASS'Y DRWG. 4008053
FAB DWG: 500B060
ARTWORK: 500B059

4008053	R-850A
4008053	R-810A
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN	
CHECKED MMS	6/9/82
	7/13/85

METROTECH
Underground Locator Products

DISPLAY

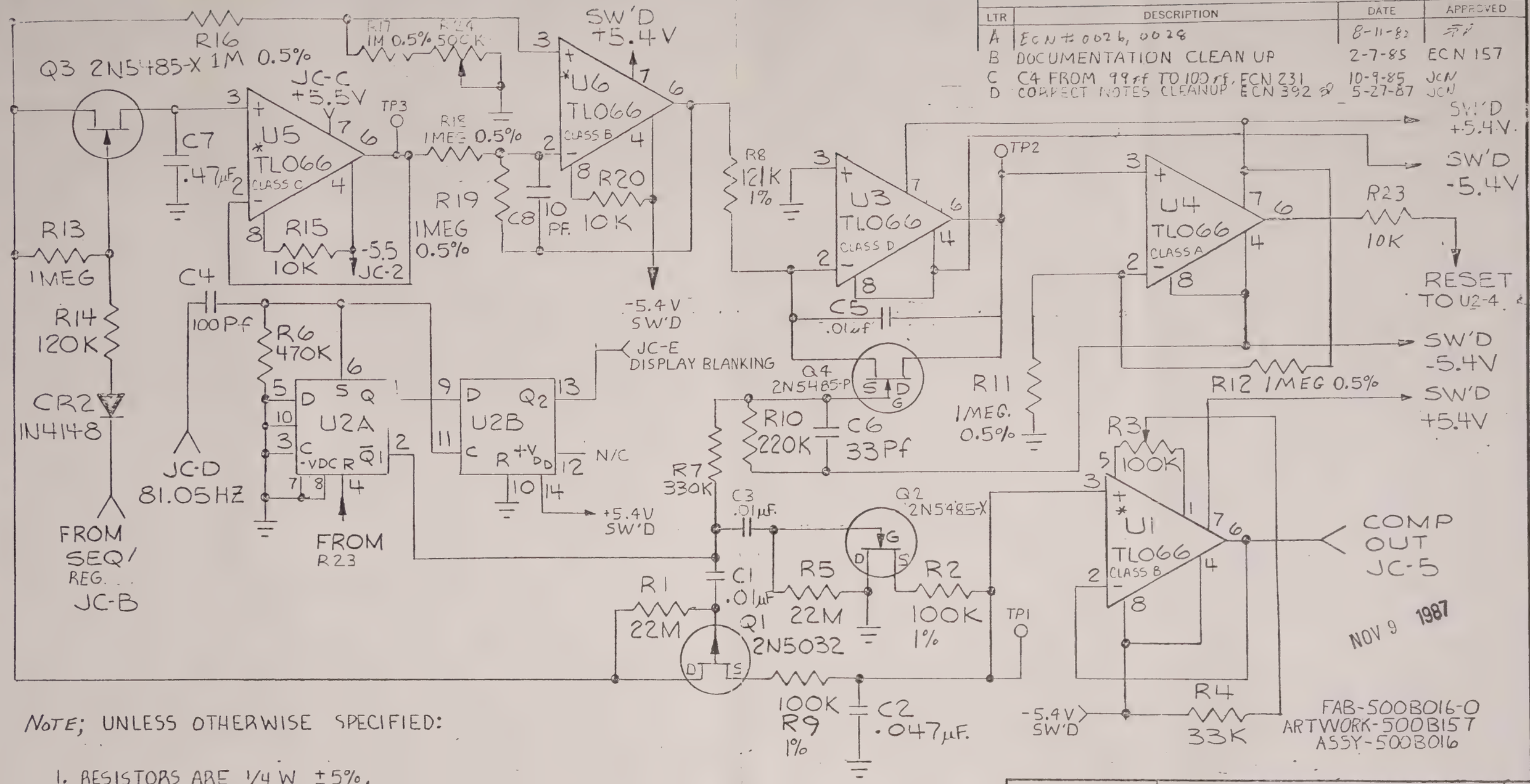
810A/850A

SCALE | SIZE B | DRAWING NO. 1008024

DO NOT SCALE DRAWING | SHEET 1 of 1

BISHOP GRAPHICS INC
PLOT FILE NO. 20621

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ECN # 0026, 0028	8-11-82	
B	DOCUMENTATION CLEAN UP	2-7-85	ECN 157
C	C4 FROM 99pf TO 100pf. ECN 231	10-9-85	JCN
D	CORRECT NOTES CLEANUP ECN 392	5-27-87	JCN



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FAB-500B016-0
ARTWORK-500B15T
ASSY-500B016

NOTE; UNLESS OTHERWISE SPECIFIED:

1. RESISTORS ARE 1/4 W ±5%.

JC-F → +5.4V
JC-6 → -5.4V
JC-A → ⏚

LAST USED				
U6	Q4	CR2	R24	C8
NOT USED				
CR1	R21	R22		

500B016	R-850A	DRAWN	
500B016	R-810A	CHECKED	6-9-82
NEXT ASSY	USED ON		
APPLICATION			

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ± DEC ± ANGLES ±

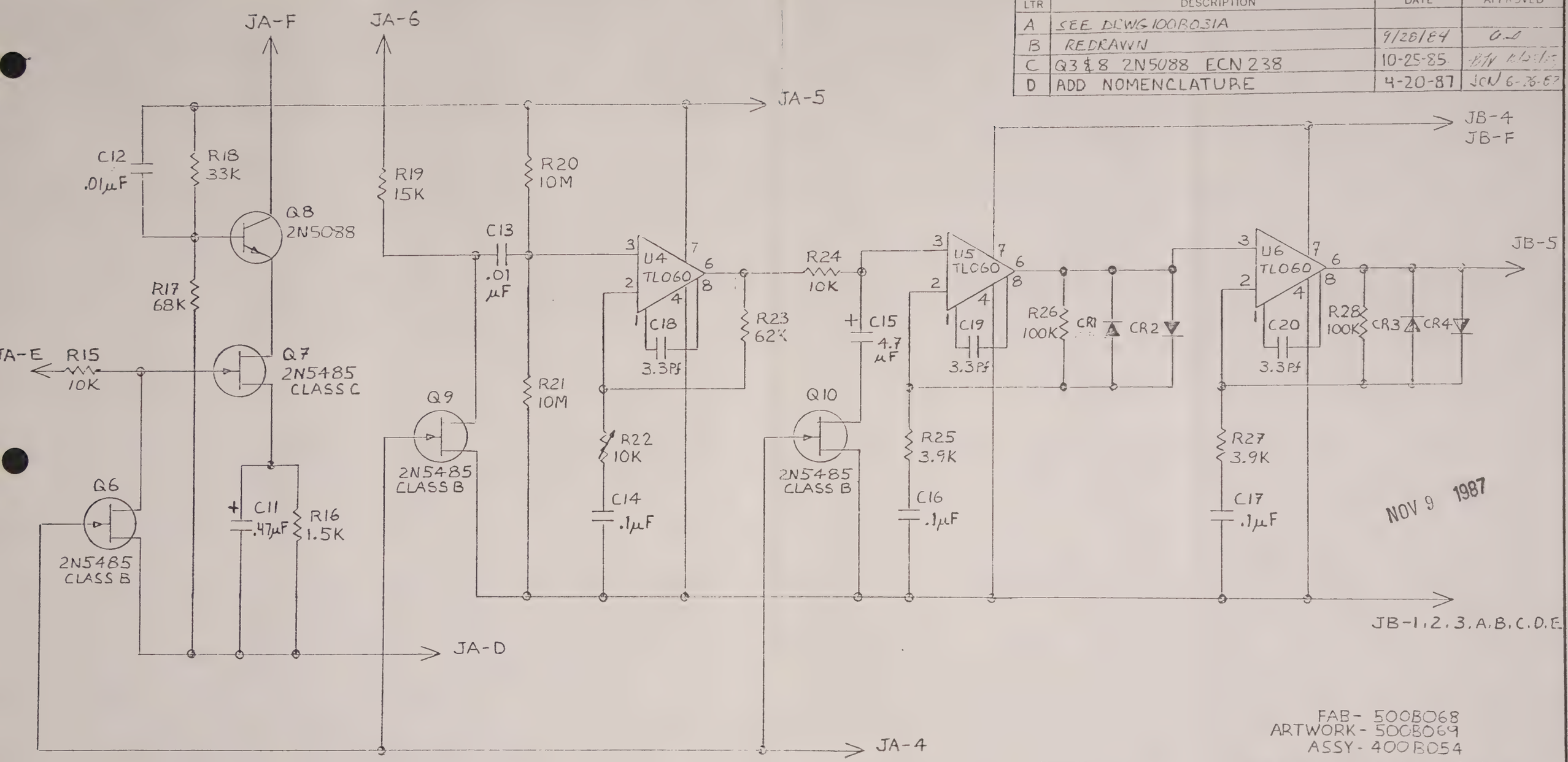
METROTECH
Underground Locator Products

COMPUTER
(PLUG IN) BD.
810/810A/850/850A

SCALE	SIZE	DRAWING NO.
	B	100B025
DO NOT SCALE DRAWING		SHEET 1 OF 1

BISHOP GRAPHICS INC
REORDER NO. 20621

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	SEE DCWG 100B031A		
B	REDRAWN	9/28/84	D.D
C	Q3 & 8 2N5088 ECN 238	10-25-85	[illegible]
D	ADD NOMENCLATURE	4-20-87	JCN 6-26-87



NOV 9 1987

FAB- 500B068
ARTWORK- 500B069
ASSY- 400B054

NOTES; UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS ARE 1/4 W ± 5%.

NOT USED
LAST USED: CR4, U6, Q10, C20, R28

400B054	R-850A
400B054	R-810A
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ± DEC ± ANGLES ±

APPROVALS	DATE
DRAWN	
CHECKED	9/28/84
	2/13/85
	8/55

METROTECH
Underground Locator Products

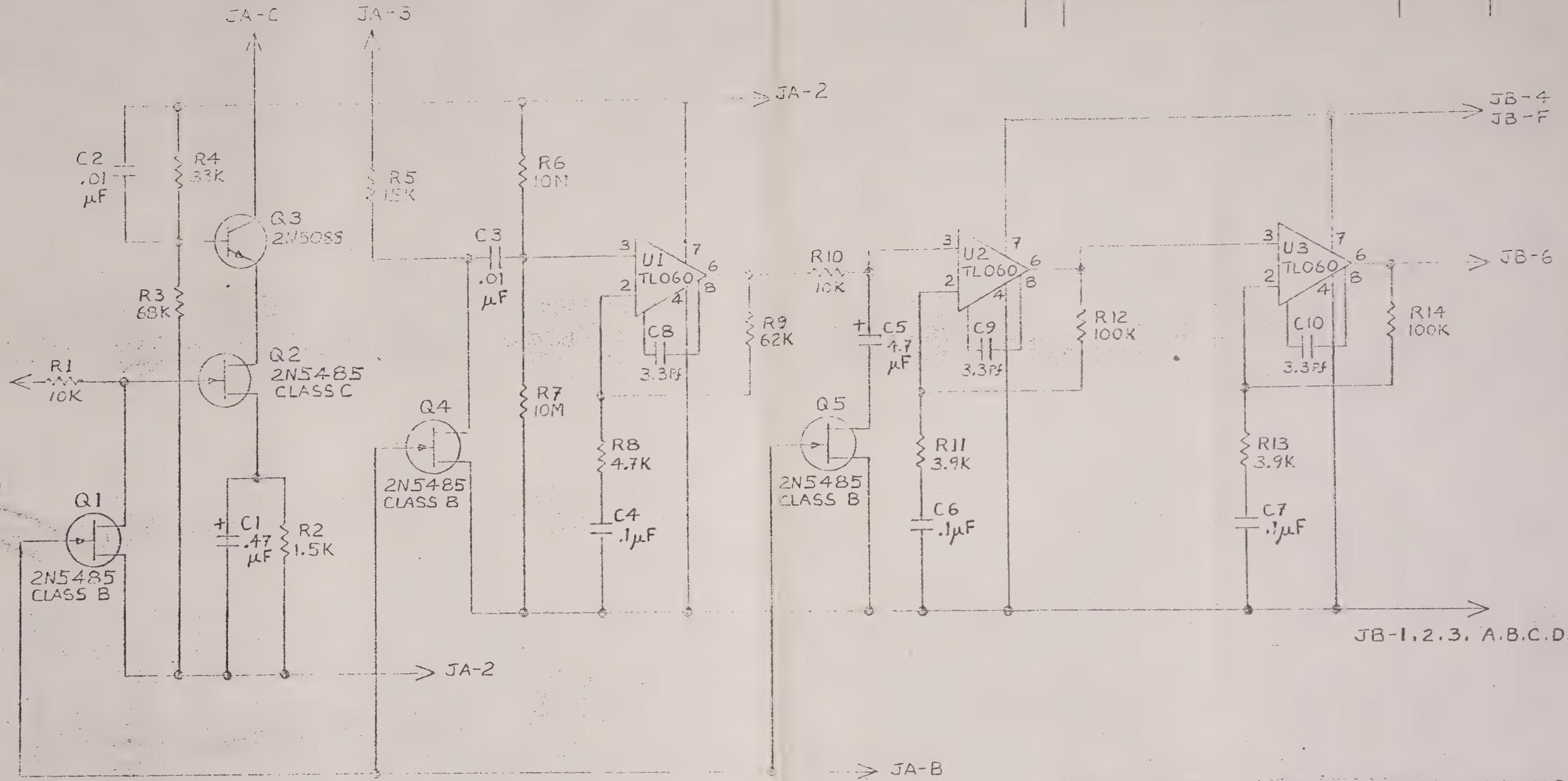
SCHEMATIC, AMPLIFIER L/R CHANNEL (PLUG IN) BD.

810/810A/850/850A

SCALE | SIZE B | DRAWING NO. 1008031

DO NOT SCALE DRAWING | SHEET 1 OF 2

SHOP GRAPHICS INC



400B054	R-850A
400B054	R-810A
NEXT ASSY	USED ON
APPLICATION	

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS DEC ANGLES
± ± ±

APPROVALS	DATE
DRAWN	9/28/84
CHECKED	9/28/84
	2/2/85
	2/5/85

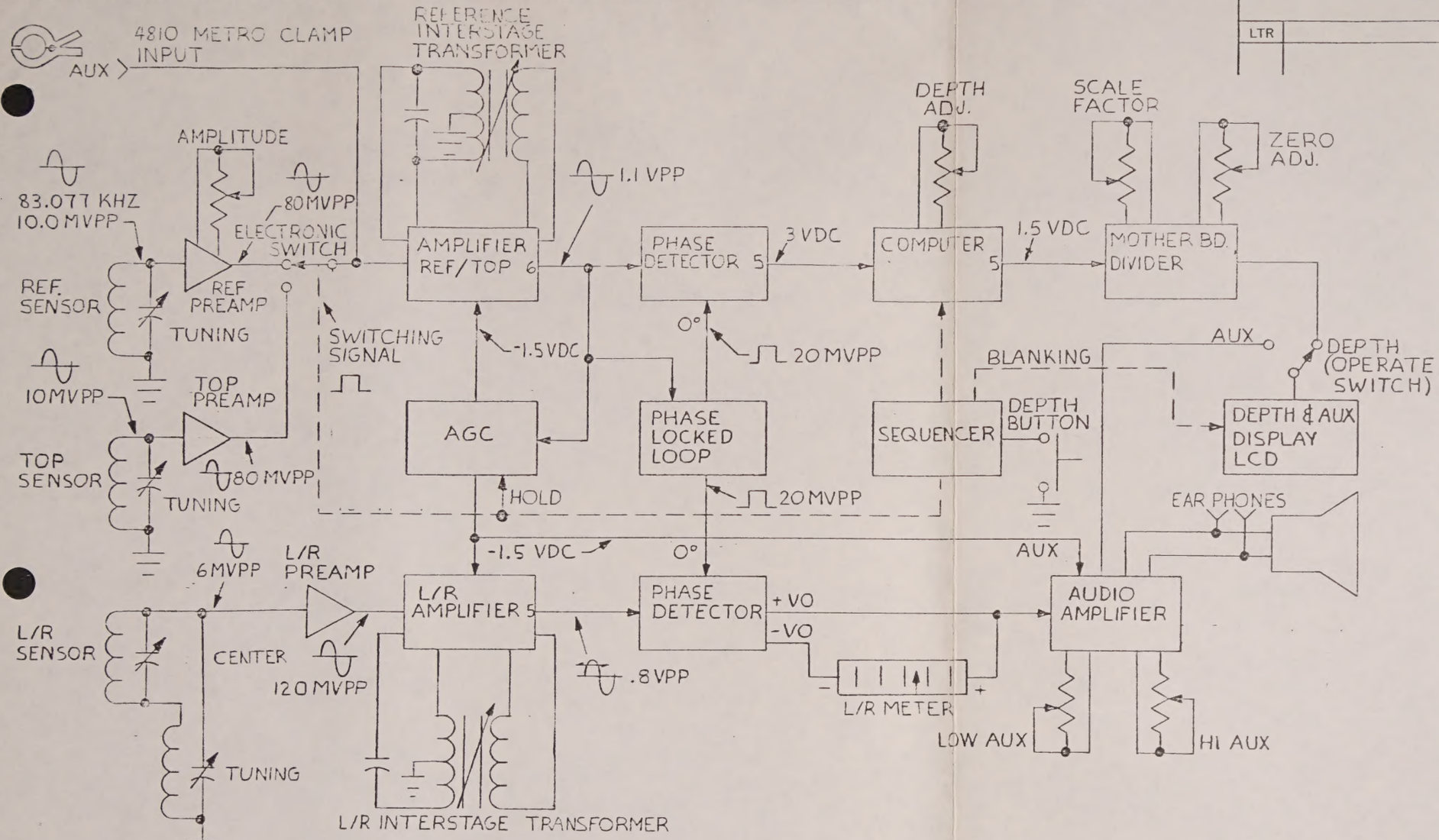
METROTECH
Underground Locator Products

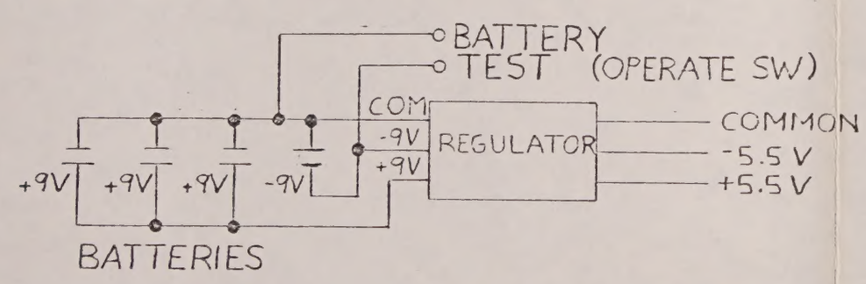
SCHEMATIC, AMPLIFIER
REFERENCE CHANNEL

SCALE | SIZE B | DRAWING NO. 100B031

DO NOT SCALE DRAWING | SHEET 2 OF 2

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED





SEQUENCE AFTER DEPTH BUTTON PUSHED.

1. AGC IS HELD FOR 7 SEC.
2. TOP SENSOR OUTPUT IS SWITCHED TO THE INPUT OF THE REF/TOP AMPLIFIER.
3. THE COMPUTER IS SWITCHED ON FOR 7 SEC.
4. THE AUDIO IS TURNED OFF FOR 7 SEC.
5. THE DISPLAY IS:
   A. BLINKING FOR 0-2 SEC.
   B. OFF FROM 2-3 SEC.
   C. DEPTH DISPLAYED 4-7 SEC.

CHECK PRINT

NOTES:

1. DASHED LINES INDICATE SIGNALS WHEN DEPTH BUTTON IS PUSHED.
2. VOLTAGES ARE PRESENT WHEN A PROPERLY OPERATING RECIVER IS IN THE OPERATE MODE (NO DEPTH) AND PLACED ON THE UNIFORM MAGNETIC FIELD GENERATOR AND ENERGIZED BY A 810 TRANSMITTER.

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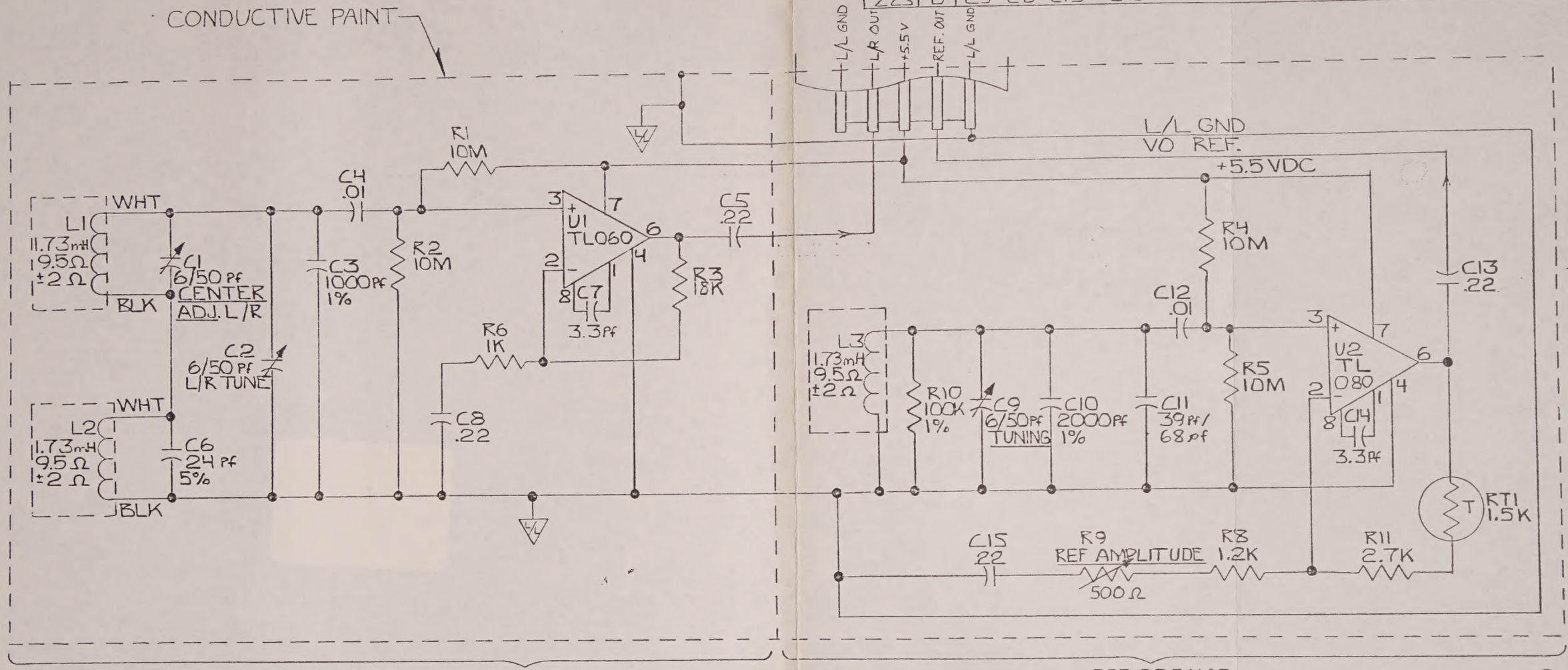
TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONS DEC ANGLES ± ± ±		METROTECH Underground Locator Products	
APPROVALS	DATE	810A RECIVER SIMPLIFIED BLOCK DIAGRAM	
DRAWN MV	12-3-84		810/810A
CHECKED		SCALE —	SIZE B
		DRAWING NO. 100B038	
		DO NOT SCALE DRAWING	SHEET 1 of 1

REVISIONS				
E.C.N.	REV.	DESCRIPTION	DATE	APPROVED
181	B	C6 REVISED AS PER ECN 181	5-24-85	
209	C	REVISED AND REDRAWN		JCW
223	D	C5 C8 C13 & C15 SUB	10-1-85	



L/R PREAMP

REF. PREAMP

NOV 9 1987

NOTES:

1. XXX: SPECIAL INSTRUCTIONS.
2. [ ]: PARTS LOCATED OFF OF BOARD.
3. VOLTAGES PRESENT WHEN A SENSOR IS PLACED ON A UNIFORM MAGNETIC FIELD GENERATOR WITH +5.5 VDC APPLIED AND ENERGIZED BY A 810 TRANSMITTER.
4. NOT USED: R7
   LAST USED: R11, C15, L3, U2, RT1.
5. FORMERLY 100B039 AS PER ECN 209.

FAB: 500B104
ARTWORK: 500B103
ASSY : 400B118

400C087	R-810A
400B118	R-810A
NEXT ASSY	USED ON

APPLICATION

ITEM NO.	QTY REQD	REF. DESIG.	PART NO.	DESCRIPTION

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL

FINISH

DO NOT SCALE DRAWING

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APPROVALS	DATE
DRAWN Brian Thompson	8-19-85
CHECKED JCN	8-21-85
ISSUED	

METROTECH
Underground Locator Products

SCHEMATIC, R-810 L/R & REF. PREAMP (VERSIONS I & II)

SIZE	DWG. NO.	REV.
B	100B043	1

SCALE — SHEET 1 OF 1

BISHOP GRAPHICS/ACCUPRESS REORDER NO. 432715

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